The Electrical Industry's Weekly Magazine December 28, 1959

Electrical World

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A McGraw-Hill Publication

Survey of the '60's: People, Production, Power .....

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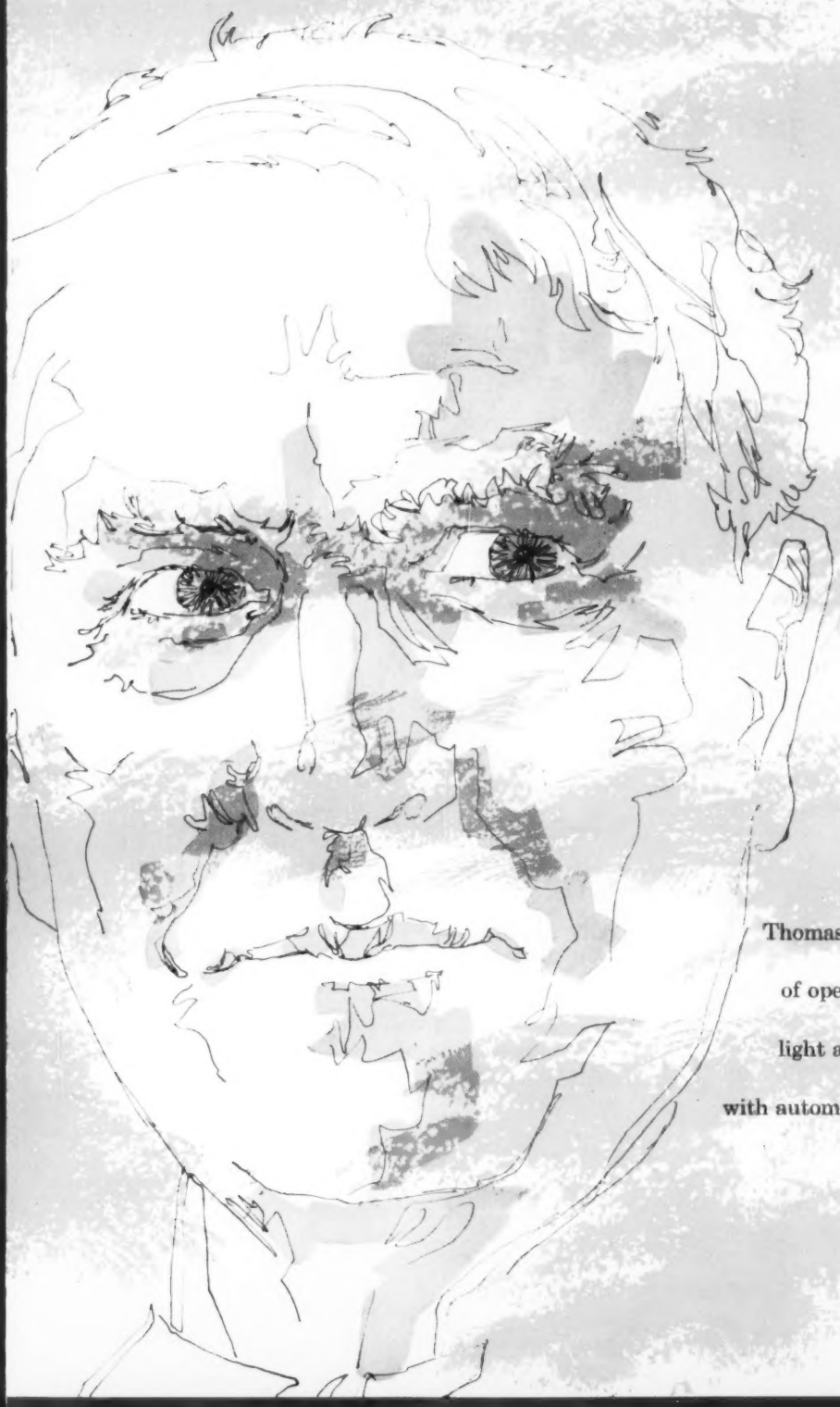


Thomas Edison dreamed of operating an electric light and power system with automatically governed operating units.

THE AUTOMATIC POWER PLANT is an engineering reality today

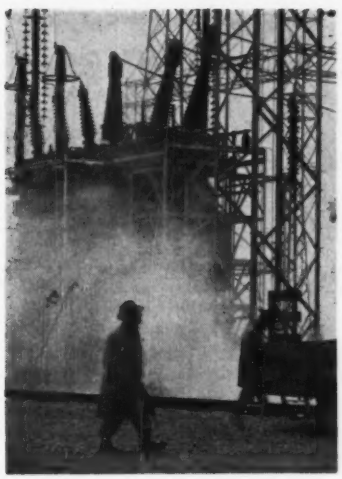
FOR DETAILS OPEN THIS FOLD...

Electrical World

Vol. 152, No. 26 DECEMBER 28, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



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Deluge-type system of two substations guards 345-kv main transformers; design can accommodate expansion...p 66

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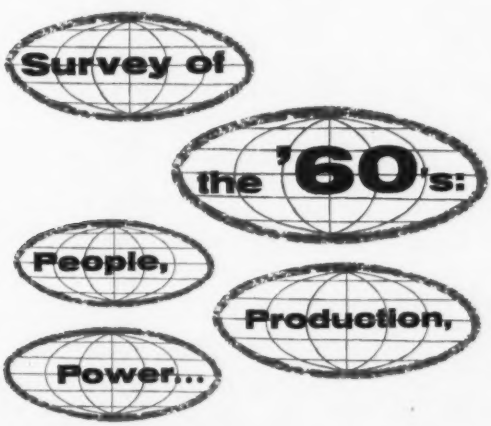

Survey of the Sixties

Electrical World editors essay a comprehensive word picture of the people, production, and power that will shape the nation's advances in the decade ahead. It is a picture of great expansion in population and production. It is an imaginative forecast of the revolutionary planning techniques, the technological progress, the changing load patterns, along with the probable regulatory and political climates that will mold utility systems and operations in the next decade.....p 69

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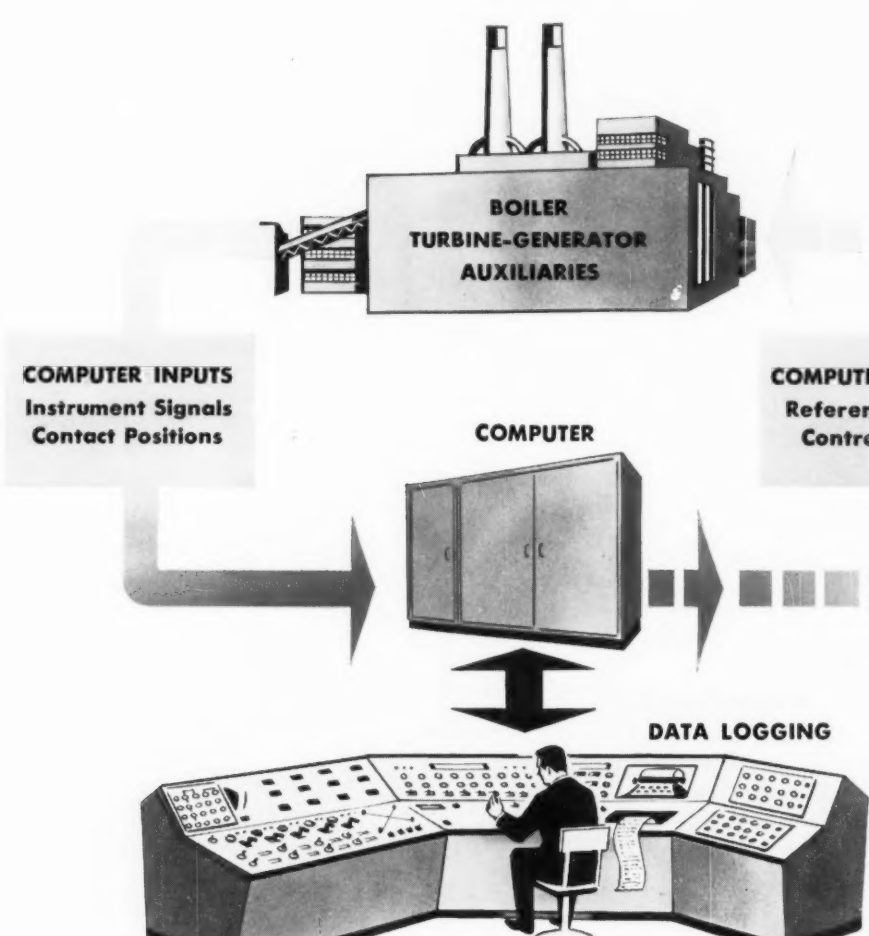
General Electric reports to the ele

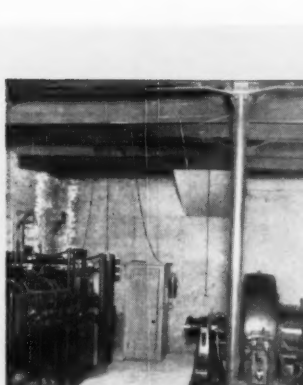


GENERAL ELECTRIC'S DEPTH OF EXPERIENCE IN SYSTEM DESIGN

General Electric's competence in power plant automation extends well beyond its ability to design and manufacture many of the complex components of the system.

81 YEARS OF EXPERIENCE in the utility field has given General Electric distinctive skills in integrating many and varied types of equipment into reliable and smoothly operating *systems*.

AUTOMATION DEVELOPMENTS pioneered by General Electric, in co-operation with its utility customers, cover all parts of the utility system, from generation through relaying to metering. A partial listing of such developments over the years would range from the automation of hydroelectric generating stations more than 40 years ago to the development, a few years ago, of automatic load dispatching systems.



FIRST AUTOMATIC SUBSTATION
Station of the Elgin and Belvidere
pany, was developed by Gener
1914. This was a fundamental con

e electric utility industry on progress in . . .

POWER PLANT AUTOMATION

AN ENGINEERING REALITY today, the automatic power plant was a dream until recent developments in solid-state digital computers supplied the missing element: a reliable "brain" compatible with already existing sensory devices and automatic sub-loops.

GENERAL ELECTRIC'S COMPUTER CONTROL SYSTEM now makes possible completely automatic hot and cold starting, on-line corrective action, normal and emergency shutdown, and continuous control of the boiler-turbine-generator-plant auxiliaries system.

BENEFITS TO BE EXPECTED from this advanced computer control system include reduced outages due to careful preplanning of programmed action to minimize undesirable operating conditions and human errors. Improved fuel economy should also result from the availability of continuous information on plant and component efficiencies, and from the allocation of load schedules in accordance with actual (instead of historical) operating conditions.

GENERAL ELECTRIC'S ENGINEERING COMPETENCE in the field of electric utility automation began early and has influenced all parts of generation, transmission, and distribution systems. This competence is solidly founded on the long-standing familiarity of General Electric engineers with basic phenomena in the generation, transmission, and distribution of electricity.

SEVERAL DEGREES OF POWER PLANT AUTOMATION are available to you now. General Electric will work directly with you or with your consulting engineer to design and co-ordinate anything from an improved and automatic data acquisition system to complete automation of your power plant.

For more information on this dramatic new development, write to the General Electric Co., Section 301-411, Schenectady 5, N. Y.

OMPUTER OUTPUTS
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Control Signals

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ALARM

Progress Is Our Most Important Product

GENERAL ELECTRIC

BSTATION, at the Union Belvidere Electric Com- by General Electric in mental contribution.

FIRST AUTOMATIC POWER PLANT, a hydro-electric plant, was installed at Cedar Rapids in 1917. It was developed by General Electric for the Iowa Railway and Light Company.

FIRST SYSTEMS PLANNING AID was offered to electric utilities over 40 years ago by General Electric. A-C network analyzers (above) have been used since 1929.

FIRST APPLICATION OF COMPUTERS to automating the design of heavy electrical apparatus was pioneered by General Electric. Computers help solve once unsolvable problems.

POWERS American

PRESENTS THE SERIES PM-30 "Pole-Master®"

OSCILLATING HYDRAULIC DERRICK

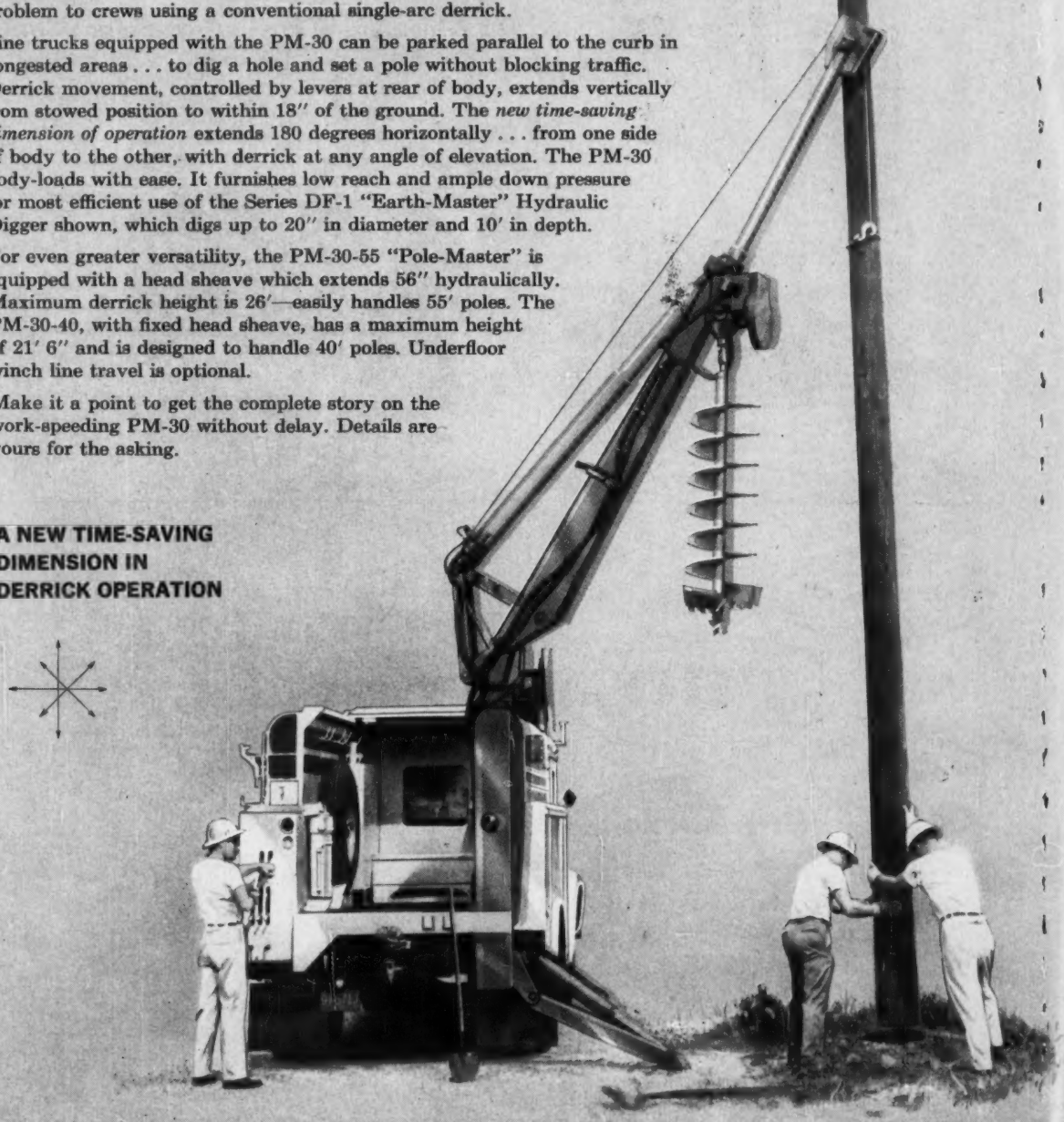
Think of the time that can be saved with this all-new "Pole-Master." Its scope of operation—*to each side as well as to the rear*—completely eliminates the necessity of positioning the truck precisely for each job. In alleys and narrow streets, the PM-30 handles work in cramped space which would present a job-delaying problem to crews using a conventional single-arc derrick.

Line trucks equipped with the PM-30 can be parked parallel to the curb in congested areas . . . to dig a hole and set a pole without blocking traffic. Derrick movement, controlled by levers at rear of body, extends vertically from stowed position to within 18" of the ground. The *new time-saving dimension of operation* extends 180 degrees horizontally . . . from one side of body to the other, with derrick at any angle of elevation. The PM-30 body-loads with ease. It furnishes low reach and ample down pressure for most efficient use of the Series DF-1 "Earth-Master" Hydraulic Digger shown, which digs up to 20" in diameter and 10' in depth.

For even greater versatility, the PM-30-55 "Pole-Master" is equipped with a head sheave which extends 56" hydraulically. Maximum derrick height is 26'—easily handles 55' poles. The PM-30-40, with fixed head sheave, has a maximum height of 21' 6" and is designed to handle 40' poles. Underfloor winch line travel is optional.

Make it a point to get the complete story on the work-speeding PM-30 without delay. Details are yours for the asking.

A NEW TIME-SAVING DIMENSION IN DERRICK OPERATION



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LETTERS

Doesn't Work Out That Way

To the Editor:

I read with interest the article entitled "High Dividend Payout or Low?" in the Management Newsletter section of the November 9th issue of Electrical World.

From the top table on page 107 there would appear to be some evidence, however sketchy, that the higher the payout (within limits) the higher the price-to-earnings ratio, and consequently the higher the selling price of the common stock. This is in accord with one's preconceived notions on this subject.

The table at the bottom shows, at least for large companies, that the higher the percentage of common equity, the higher is the average price-to-earnings ratio. The accompanying text makes this same point, giving percentage increases.

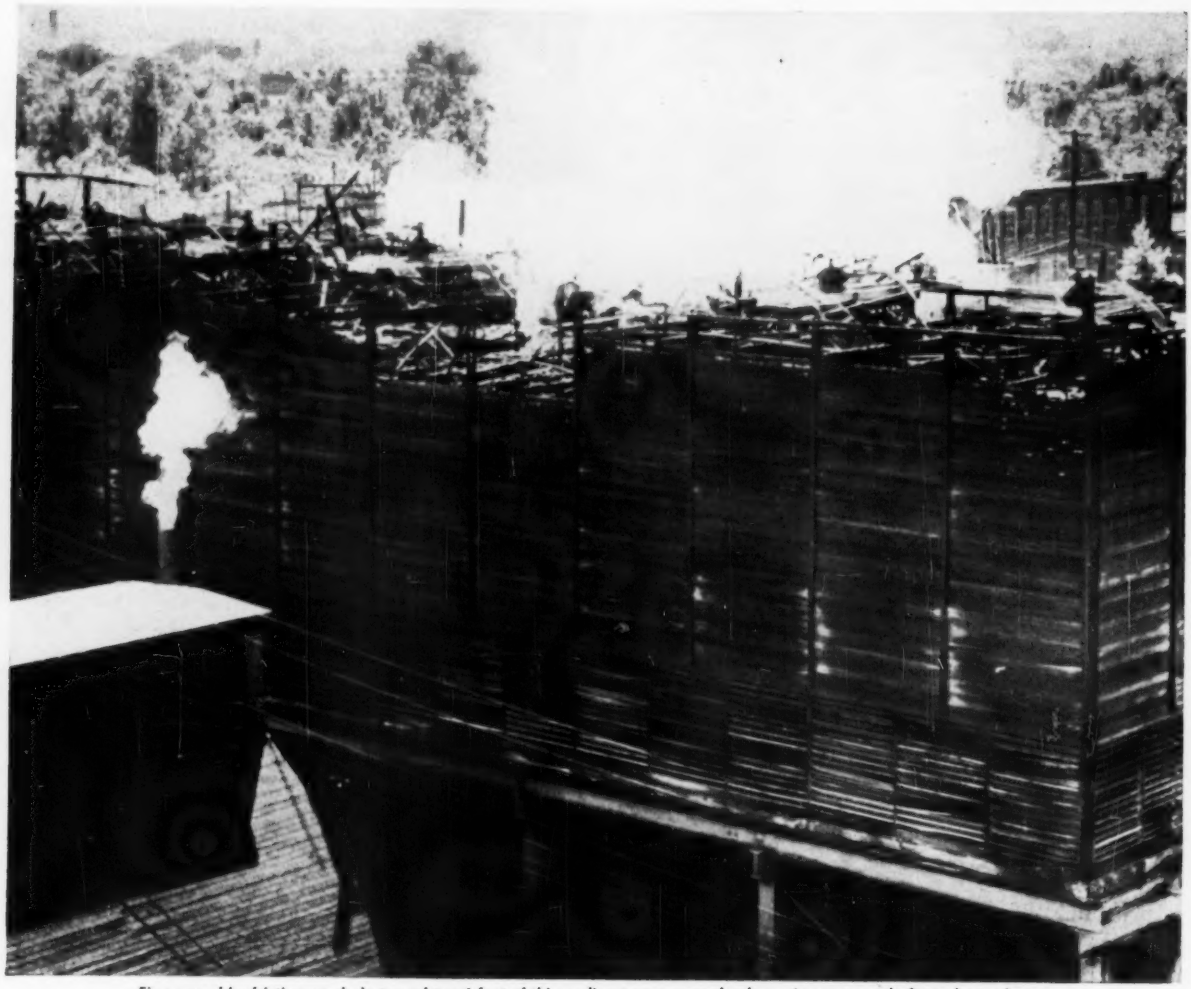
Without further analysis one might draw the surprising conclusion that the higher the common equity percent, the higher the market price of the stock. This is an erroneous conclusion to draw, and one which I think your analyst might well have pointed out.

To show that this conclusion is erroneous, I have prepared simplified calculations which show that the stock selling price for the less than 35% common equity will be as high or higher than the stock selling price of the greater than 45% common equity. This result arises from the fact that there is a ceiling on earnings for public utilities based on the total investment in the business and, as the percent of common equity decreases for a fixed percentage earnings on total investment, the leverage principle causes a higher percentage return on the common equity.

I think it would be well for your analyst to take the large companies involved in the lower half of the table on page 107 and make a more exact calculation than my simplified, hypothetical one. I rather suspect that he will arrive at the same conclusion and if he does, the material might form a subject matter for a follow-up article.

E. H. Smoker, President
The United Gas Improvement Co
1401 Arch Street
Philadelphia 5, Pa.

We did not intend the article to have anything to do with the existing capital structure proportions, but rather to deal only with the question of whether it was best to add the $1 earnings to the common stock equity—or pay it out in dividends. As you suggest, we hope in the coming months to do an article on the most advantageous type of utility capital structure.



Fire caused by friction spark destroyed top 6 feet of this cooling tower, severely damaging motors, shafts and gear boxes.

Protect your water cooling tower from crippling fire with a Grinnell System!

Water cooling towers are essential in many industries today. But cooling towers can, and do, *burn*! Furthermore, fire may strike when the tower not only is shut down, *but even while it is in use*. One insurance company has stated that nearly half its losses involving towers occurred when the towers were in operation!

Why are cooling towers so vulnerable to fire? Because they are largely made of wood. It is true that when the tower is operating most of the wood is wet. But roof and sides can become excessively dry through exposure to the sun. Also, there is a portion of the tower above the cooling water distribution system that is never wet.

Your best protection against an unexpected blaze is a Grinnell Water Spray or Automatic Sprinkler System. Grinnell will engineer an installation for you that will protect your tower — possibly your entire production program — against fire, no matter how it may start. Common causes of fire include defective wiring, overheated bearings, and lightning. So call in a Grinnell engineer. Let him analyze your needs. Remember, he is well qualified to help you . . . backed by a company with 89 years experience in the fire protection field. Grinnell Company, Providence 1, Rhode Island.

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Fire Protection Systems Since 1870

You can save money on crew time with Graybar as your auxiliary warehouse

On a single Graybar order, you can enter all the materials you need for, let's say, a complete distribution line project . . . and you will receive every item on schedule. Starts need not be delayed for lack of materials if Graybar is your auxiliary warehouse.

When the unexpected happens . . . emergency requirements . . . additional fill-in items . . . special tools . . . call Graybar. We are geared to handle the unusual. Even on large transmission line projects, we furnish prefabricated crossarm assemblies . . . another time-saving specialty of Graybar.

Start with a local call . . . Call in your local Graybar man and talk it over with him.

Employee-owned Graybar has been "on the line" and part of the local scene for years. Whether you require 3 items or 3,000, Graybar is your most practical source for most utility electrical equipment and supplies.

When Graybar is your auxiliary warehouse –	You save on storeroom costs Reduce inventory investment Insure prompt delivery Step up man-hour efficiency Simplify bookkeeping

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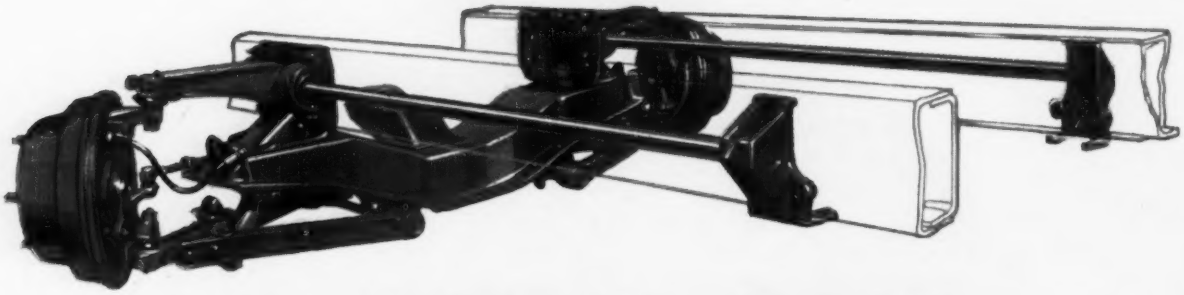
LOCAL SERVICE TO UTILITIES THROUGH COAST-TO-COAST WAREHOUSING



CHEVROLET'S REVOLUTIONARY TORSION-SPRING RIDE

the most significant new truck development in decades!

Years of intensive engineering achieved a revolutionary result—a totally new truck suspension system. The most exhaustive chassis engineering program in trucking history proved conclusively that, from the standpoints of both ride and durability, the finest possible truck suspension system would consist of independently suspended front wheels with torsion bar springing. Advancing on this principle, Chevrolet engineers proceeded through years of development to produce a completely new system for the 1960 Chevrolet truck product.

New Torsion-Spring Ride—how it works. The revolutionary result of Chevy's all-out engineering effort—Torsion-Spring Ride—eliminates both the old-fashioned I-beam front axle and friction-producing front leaf springs. Each front wheel, suspended independently of the other through tough control arms and low-friction linkage, is free to step cleanly over bumps without jarring the entire truck. Also, friction-free torsion bars on either side of the chassis, specially mounted to provide a twisting action, work to absorb each jolt; they flex freely to soak up all kinds of shocks, from the smallest to the most severe.

Three new rear suspensions, tough and tailored to the truck, are completely redesigned to complement the independent front suspension in every weight class.

M70 tandem proves its stamina on year-long test of durability.

Here's a ride that lets you get more work done in a day's time! Take a '60 Chevrolet truck over a rough stretch of back road and feel the absence of I-beam shimmy and wheel fight. Chevy's torsion springs soak up jolts and jars that would shake the headlights off an ordinary I-beam rig. You move along with maximum payloads at higher safe cruising speeds. You make your tough off-the-highway runs in less time, improving your ton-mile-per-hour rate as much as 100%.

A ride that shows respect for the driver and the load! Out at the GM Proving Ground, the test drivers will take a torsion-spring Chevy any day over an I-beam truck—even if they have to drive it twice as far. The ride's that much better; that much safer. The load, too, has an easier time of it. There's far less bounce and jounce, less danger of damaging fragile cargoes.

A ride that adds extra thousands of miles to the truck's working life! You can be sure the shockproof action of Chevrolet torsion-spring ride means lower maintenance costs. As much as 78% of all objectionable road shock and vibration is absorbed before it can be transmitted to the truck's body and sheet metal. Chevy trucks stay new-looking a whole lot longer and their working life is increased by extra thousands of miles.

Once you've experienced the incredible smoothness of a torsion-spring ride, you'll realize that Chevrolet has set off a full-scale revolution with the introduction of its '60 models. By throwing away the old-fashioned I-beam in favor of independent front suspension, Chevy's new design has improved virtually all phases of truck performance. Drive a new one just once. That's all we ask. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

1960 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET

THEN
.. and NOW
Since 1950, Southwire has grown from 10,000 to 250,000 square feet—an independent wire and cable manufacturer with skilled manpower to match the most modern equipment available.
SOME THINGS NEVER CHANGE AT SOUTHWIRE

Sure, a fellow may have to walk a little farther from his car to the plant, or use the telephone to get information instead of stepping into the next office for it — but at heart we're still a small plant in a small town, waiting anxiously for each order and eagerly watching its progress through the mill with care and pride.

We're still Jim, and Jack, and Dave, and Pete—to our customers and to each other. The order for a thousand pounds of copper wire is still important to us. And it gets the same personal attention as one for a million and a half pounds of ACSR transmission cable.

True, constantly expanding product lines, larger and more modern facilities, and continuing research programs, are added reasons for doing business with SOUTHWIRE . . . but personal attention, dependable service, and quality products, are the things that have built our business and will continue to make SOUTHWIRE a good place to trade.

SOUTHWIRE serves the world

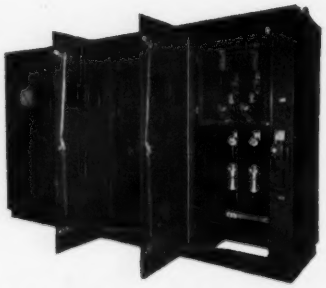
Southwire® Company

TErrace 2-6311 CARROLLTON, GEORGIA

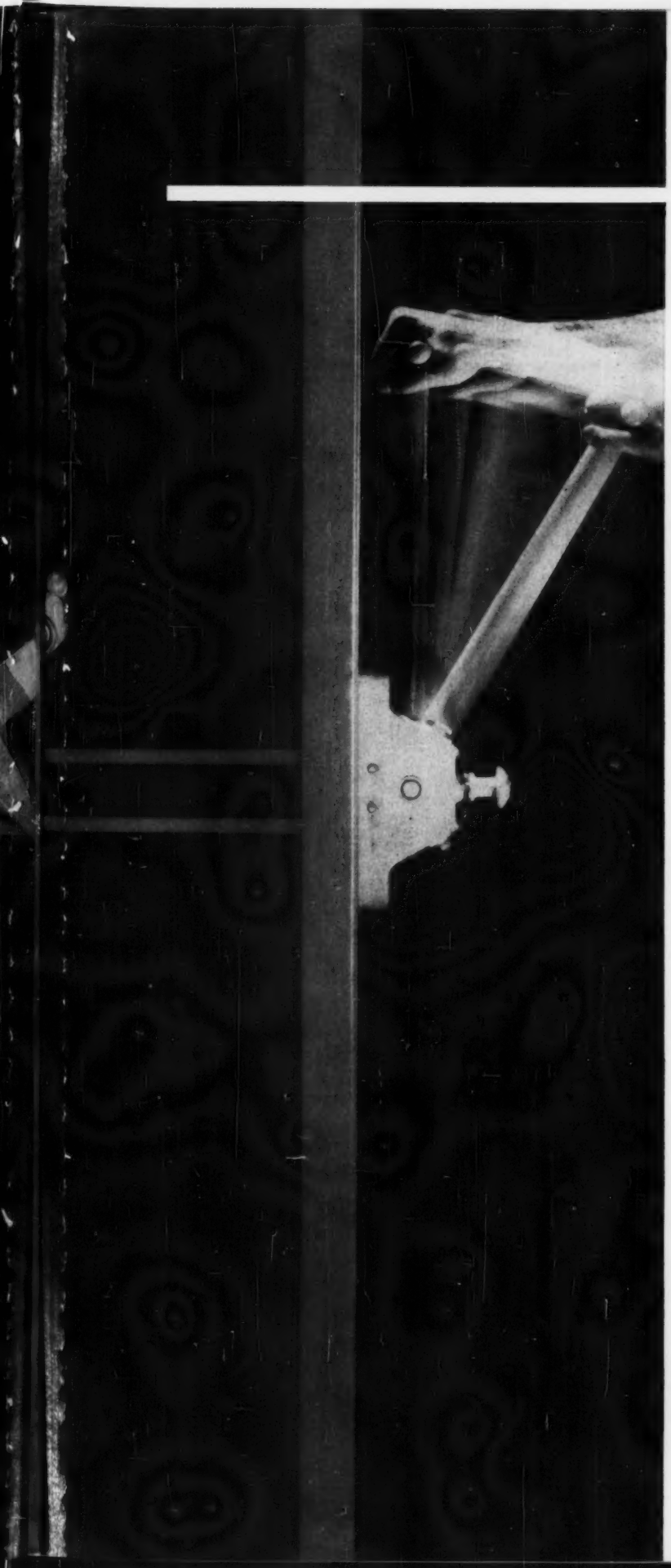
• Bare and Weatherproof Copper and Aluminum Line Wire • Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper Aluminum and Triplex • U.R.C. (DBWP, TBWP) Copper • Copperweld® Conductors • Copper and Aluminum Building Wire • ACSR and All Aluminum Cable • Galvanized Steel Guy Strand and Static Wire • Aluminized Steel Guy Strand and Static Wire • Aluminum Alloy Wire • Cable Accessories • NM Sheathed Cable

ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

FAULT CLOSING



S&C metalclad switchgear meets all requirements of new National Electric Code for fault closing, short-circuit interruption. Performance proved by high power testing at KEMA laboratories.



S&C metalclad switchgear can close on any fault up to 60,000 amps

No danger to equipment—no danger to operator even if he closes load interrupter switch on the heaviest faults. S&C's new line of metalclad switchgear is rated as high as 44,500 amps fault closing, 500 mva short-circuit interrupting at 14.4 kv. And at 4.16 kv, the corresponding ratings are 60,000 amps, 250 mva!

Here's how it works: 1) Fault never flows through interrupting unit when switch is closed . . . it flows through separate arcing contacts; 2) Arcing is minimized and magnetic forces are overcome by quick-make, quick-break toggle action no matter how slowly operator closes handle.

Short-circuit interrupting duty (up to 500 mva) is handled by a new boric acid power fuse, the Type SM, which features multiple bore construction to handle low, medium, and high faults.

The simplicity of the S&C design—power fuses for short-circuit interruption and load interrupters for manual or automatic load switching—enables you to save as much as 50 percent on your switchgear investment. Why not consider S&C Metalclad Switchgear for your high voltage power systems? In industrial plants and commercial and institutional buildings there are rarely any transient faults, so there is no real need for the automatic reclosing ability of the more expensive circuit breaker type of switchgear.

For more information please consult the telephone directory for your nearest S&C sales office.

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Specialists in High Voltage Circuit Interruption since 1918

S&C

One Of The Many Features Of The

RILEY TURBO FURNACE

Power Engineers of central stations and of large industrial power plants visiting a Riley Turbo Furnace installation burning coal are impressed at the remarkable cleanliness of the furnace . . . a major reason why more and more Turbo Furnace Boilers are being purchased. Ability of the Turbo Furnace to remain slag-free eliminates the need for slag blowing equipment and sustains an efficient furnace performance indefinitely.

Opposed firing into the Turbo Furnace hearth develops intimate mixing of fuel and air, rapid combustion at high temperature. Coals with widest range of ash fusion temperatures, ash and sulphur content, are suitable. Furnace walls stay clean because combustion gas rises vertically out of hearth in uniform stratum without turbulence and fills entire furnace cross section.

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WORCESTER, MASSACHUSETTS

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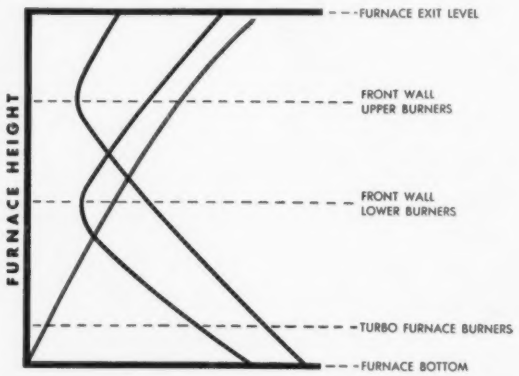
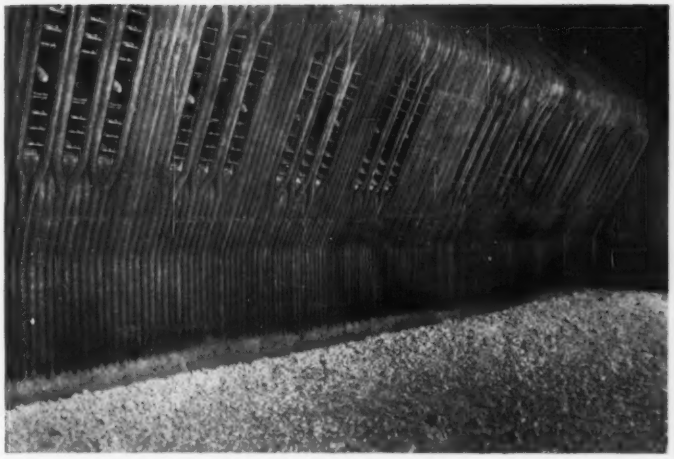


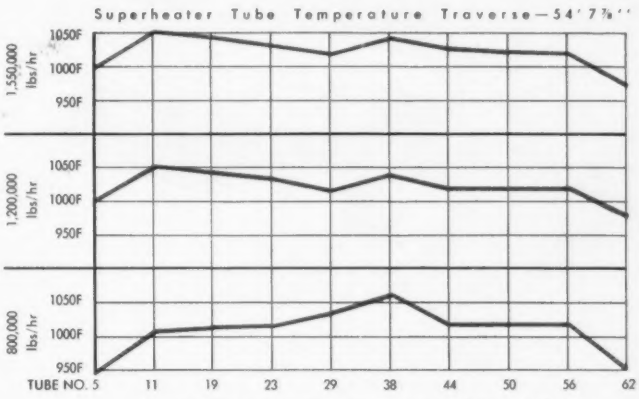
A comparison of temperature characteristics between wall firing and Turbo Furnace firing. Note with Turbo Furnace firing (red curve) highest temperature is at furnace bottom.



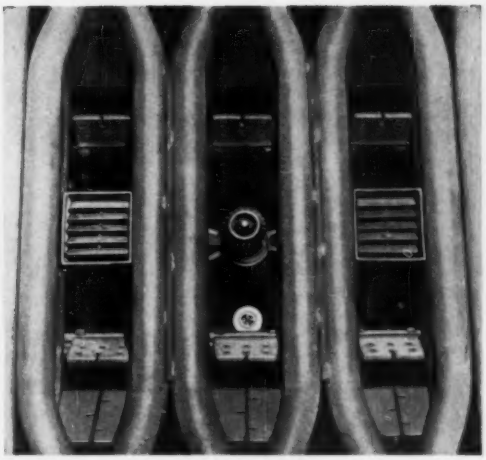
A few of 20 Burners in a 1,550,000 lb/hr Turbo Furnace Boiler. This is a 56 foot wide single furnace.

THERE ARE OTHER TURBO FURNACE ADVANTAGES, TOO!

- **Tops For Multifuels** Combustion of coal, oil, gas, fluid coke, produces substantially equal furnace performance resulting in equivalent furnace exit temperatures, simplifying steam temperature control.
- **Eliminates The Flyash Disposal Problem** Reinjected flyash is removed as an easily handled, commercially useful, quenched slag; in some instances flyash from adjacent dry-bottom boiler can be disposed of in the Turbo Furnace.
- **Extra Wide, Undivided Furnaces Are Possible** The opposed method of Turbo Furnace firing removes limitations on furnace width inherent with other methods of firing.
- **Less Space Required** The permissable higher heat release of the Turbo Furnace results in smaller structures for a given capacity.
- **One Level Operation** All Turbo Furnace burners are at one operating level — usually common with the turbine operating level.
- **Minimum Superheater Metal Temperature Variations** Linear flame from side wall to side wall produces uniform heat release throughout the entire furnace width. Furnace gases rise evenly and vertically within the furnace, resulting in a flat gradient of the skin metal temperatures of superheater and reheater tubes.



Curves Plotted From Readings Taken In Tests Conducted July 22, 1958



The Riley Directional Flame Turbo Furnace Burner is a shop assembled unit which can be equipped complete with coal, gas, oil burners and automatic gas ignitors. Adjustable vanes direct air to control flame placement. No refractory is needed.

A highly turbulent linear flame with long residence time of combustibles results from downward opposed firing. Carbon loss is negligible.

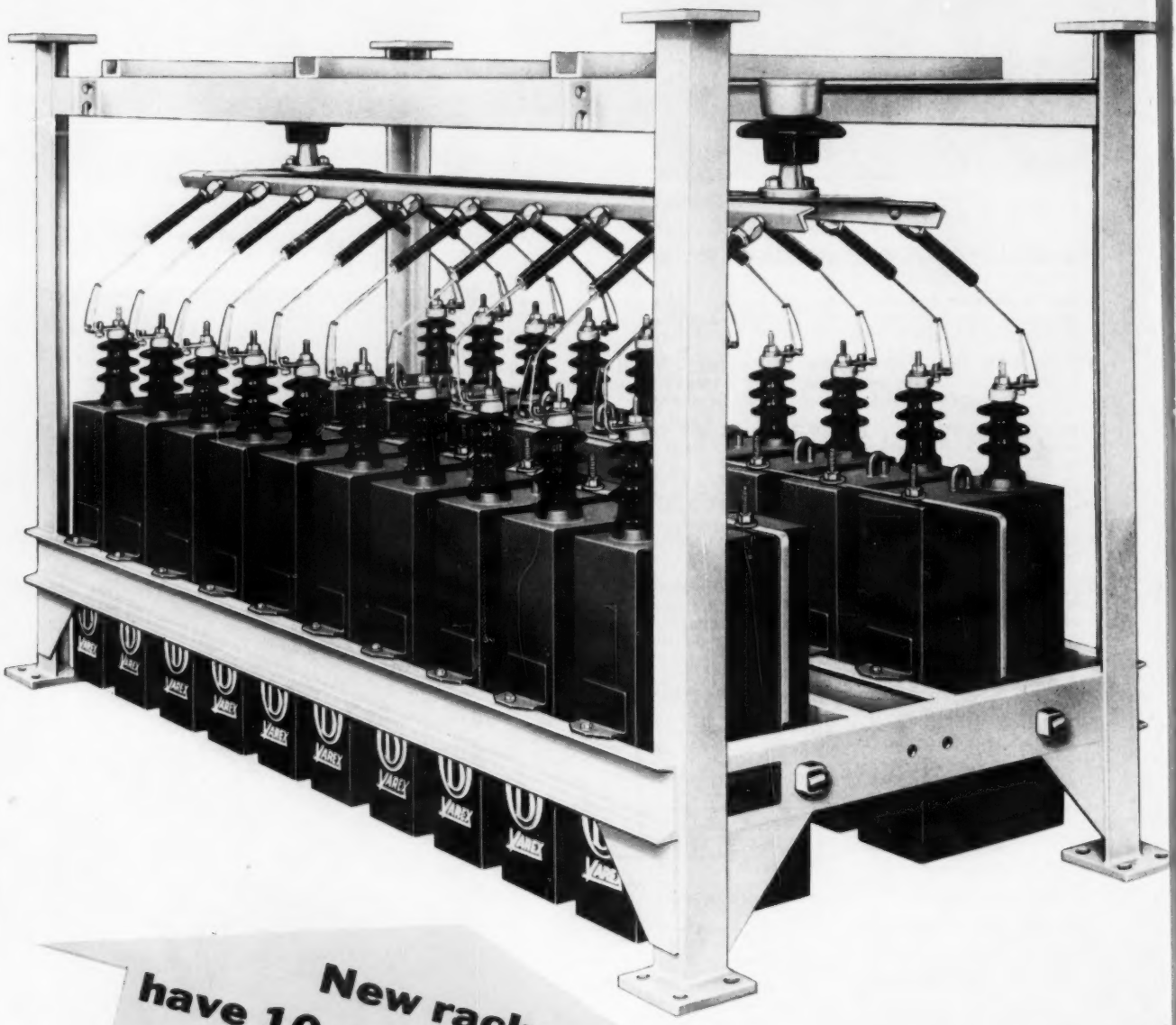
The cooled slag pool of a shut-down unit returns to molten stage when unit returns to line. Note slag discharge opening and flyash reinjection ports.

A survey of your plant by a qualified consulting engineer could show ways of making surprising savings in your power costs.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

Long-life VAREX®



New racks have 10-15% less weight, require minimum maintenance

Varex racks are jig-welded with high-speed process that makes strong, neat joints, are less subject to distortion during handling than bolted, galvanized steel racks.

capacitors *NOW* come in long-life aluminum racks

Another long-life feature has been added to the O-B capacitor lineup. Varex equipment racks are offered for the first time in light, corrosion-resistant aluminum.

The many long-life features of Varex units -- among them low temperature rise, absence of tabs in the dielectric, stainless steel terminal studs -- have already proved successful in service. Containers are either stainless steel or mild steel finished with abrasion-resistant, epoxy-resin paint. Add maintenance-free aluminum racks to the package and you have equipments that you can install and forget.

The rack itself weighs 35 to 50 per cent less than the corresponding steel rack, depending on the type and size of the equipment. The equipment weighs 10 to 15 per cent less. Reduction in weight makes equipments easier to handle and decreases pole-loading for pole-mounted capacitors.

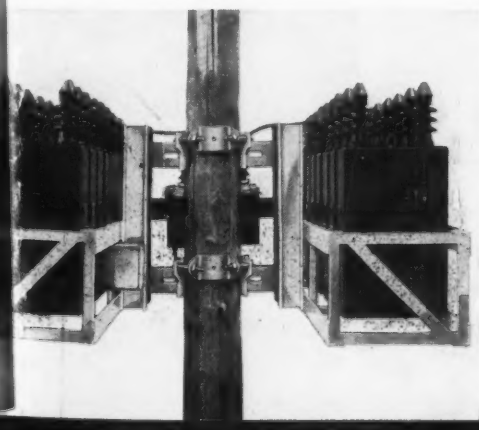
If you are on the growing list of satisfied Varex users, you'll like them even better in these new aluminum racks. Equipments are available for a wide range of voltage applications. Ask your O-B representative about them.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass (B) HOLAN

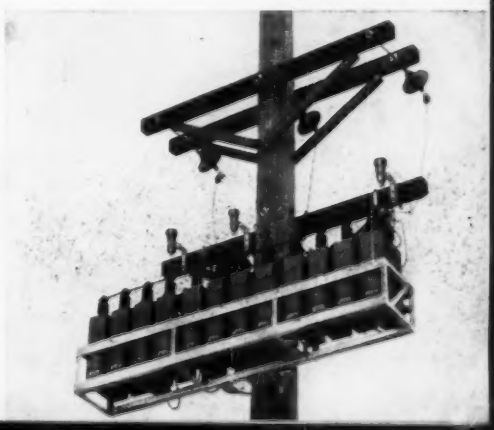
PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

4962-H

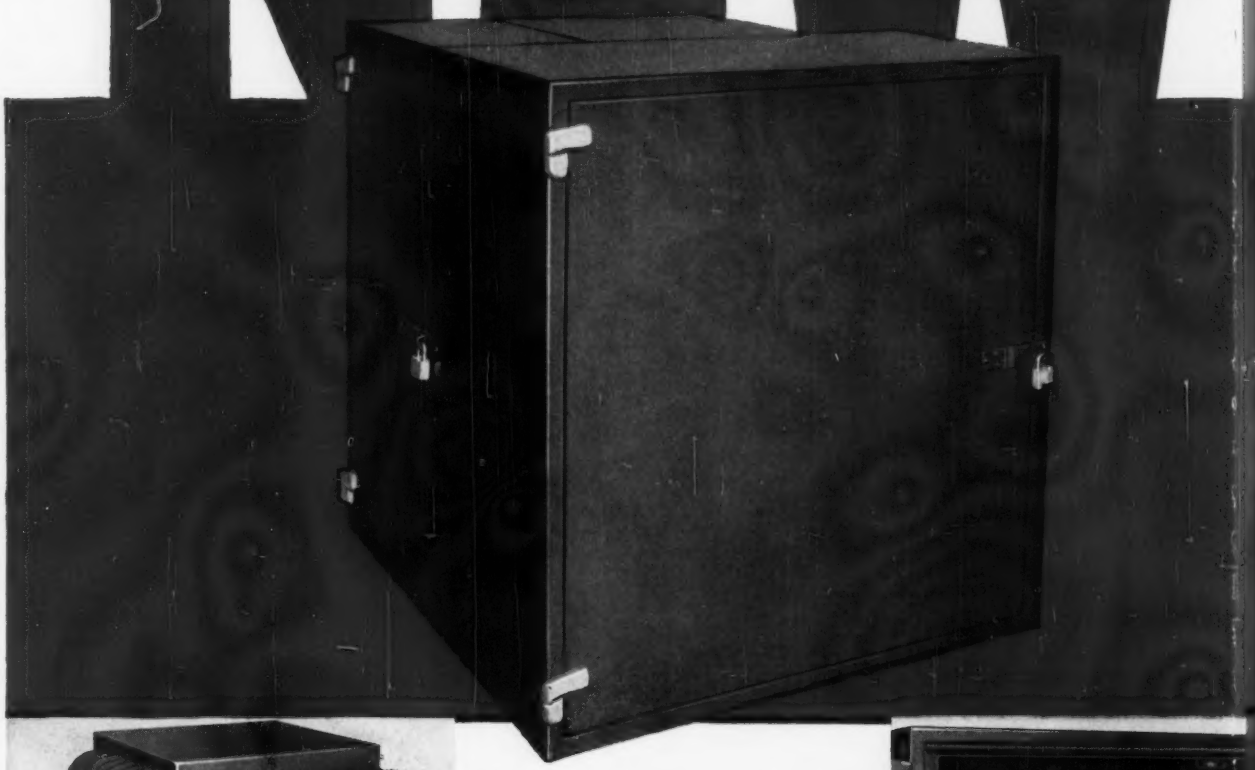


Twin-line Varex equipments equalize pole loading. Racks are made of light weight aluminum, alloy 6061-T6.

Aluminum pole-mounted equipments go up fast, reduce loading on pole.



NEW



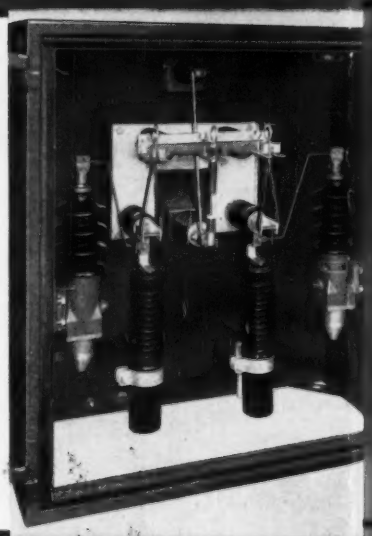
TRANSFORMATION

To provide superior performance under all operating conditions, the transformer portion of the "Unitran" has low exciting current, low impedance and high short circuit strength.

The transformer tank couples with the HV and LV compartments in such a manner that all accessories are inside the compartments.

"Unitrans" are available in voltages thru 15 KV Grd. Y, in conventional types 15 thru 167 KVA and CSP types 15 thru 50 KVA.

To provide interchangeability, a single set of compartments accommodates all sizes of transformers.



Manufacturers: Transformers for Utilities • Industry • Electronics • Factories: St. Louis 20,

MOLONEY "UNITRAN"* FOR UNDERGROUND DISTRIBUTION

PROVIDES . . . APPEARANCE, PERFORMANCE, SAFETY

The Moloney "Unitran" is a new development designed to provide a complete, compact package of transformation, protection and sectionalizing equipment for residential underground distribution systems.

The "Unitran" is a tri-component unit . . . (1) transformer, (2) LV compartment, (3) HV compartment. The basic design emphasizes performance, safety and appearance, thereby making the unit compatible with modern underground systems.

The attractive appearance of the "Unitran" provides an answer to the utilities problem of electric power distribution without overhead lines. Several exclusive features insure safety of utility personnel during installation and maintenance and eliminate the possibility of damage and hazards due to unauthorized entry. The "Unitran" has the same core-and-coil assembly as Moloney Pole Type Transformers; and thus, the same exclusive operating features and superior performance.

*Trademark

Another new item developed for underground systems is the Moloney Transformer Enclosure which provides attractive appearance and safety for standard pole type transformers. Easily assembled, the enclosure is available in sizes large enough to accommodate pole type transformers up thru 167 KVA, 15 KV.

For additional information on either the "Unitran" or the enclosure, request Bulletin #360.

H. V. COMPARTMENT

This compartment has been designed to accommodate lightning arresters, potheads or conduit, and may be provided with a fused-disconnect-and-sectionalizing switch.

This switch, which is designed for loop feeder service, can be operated under load without an external arc by using a commercially available load break tool. Thus, the switch provides for transformer protection and isolation. Other advantages of this external switch include positive visual indication, ease and speed of operation, ease of fuse replacement, and elimination of oil contamination.

L. V. COMPARTMENT

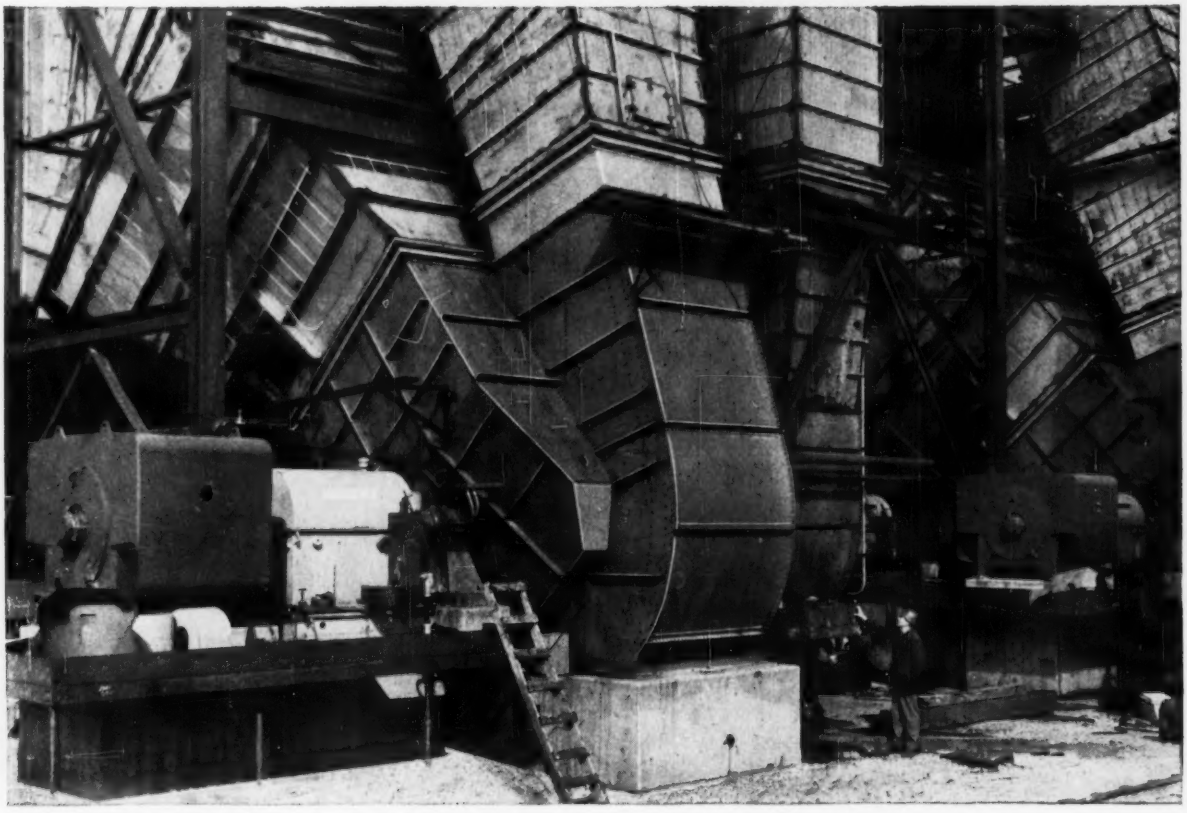
The compartments are fabricated of heavy guage sheet steel and have full width doors equipped with provisions for locking, and designed to be weatherproof and tamperproof. The door hinges are designed to permit the door to be removed quickly and easily.

The LV compartment bolts to the transformer and to the HV compartment and the walls of the compartments isolate live parts of the LV from the HV. Sufficient space is provided in the LV compartment for secondary connections and conduit.

ME59-11

MOLONEY ELECTRIC COMPANY

Mo. • Toronto, Ont., Canada • Sales Offices: All Principal Cities



HOW DO YOU SELECT MECHANICAL DRAFT FANS ?

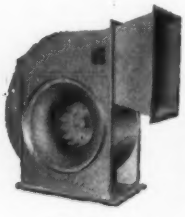
By price alone? Undoubtedly not because proper fan performance cannot be obtained by cut-rate methods. It must be engineered and built to a standard, not a price.

"Buffalo" Mechanical Draft Fans are built to an engineering standard with over 80 years experience and hundreds of installations to back it up. This engineering experience combined with "Q" Factor* construction makes the complete line of "Buffalo" Mechanical Draft Fans a best buy in the long run.

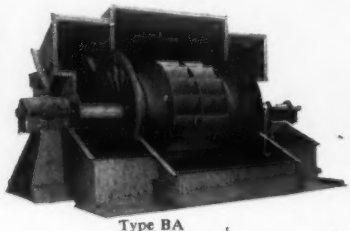
Be sure to phone your "Buffalo" Engineering Representative when you want reliable, high efficiency, long life mechanical draft fans.

*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

Type CR
Radial Blade Fan.



Type BLH
Backward Curve Fan.



Type BA
Airfoil Fan.

"Buffalo"

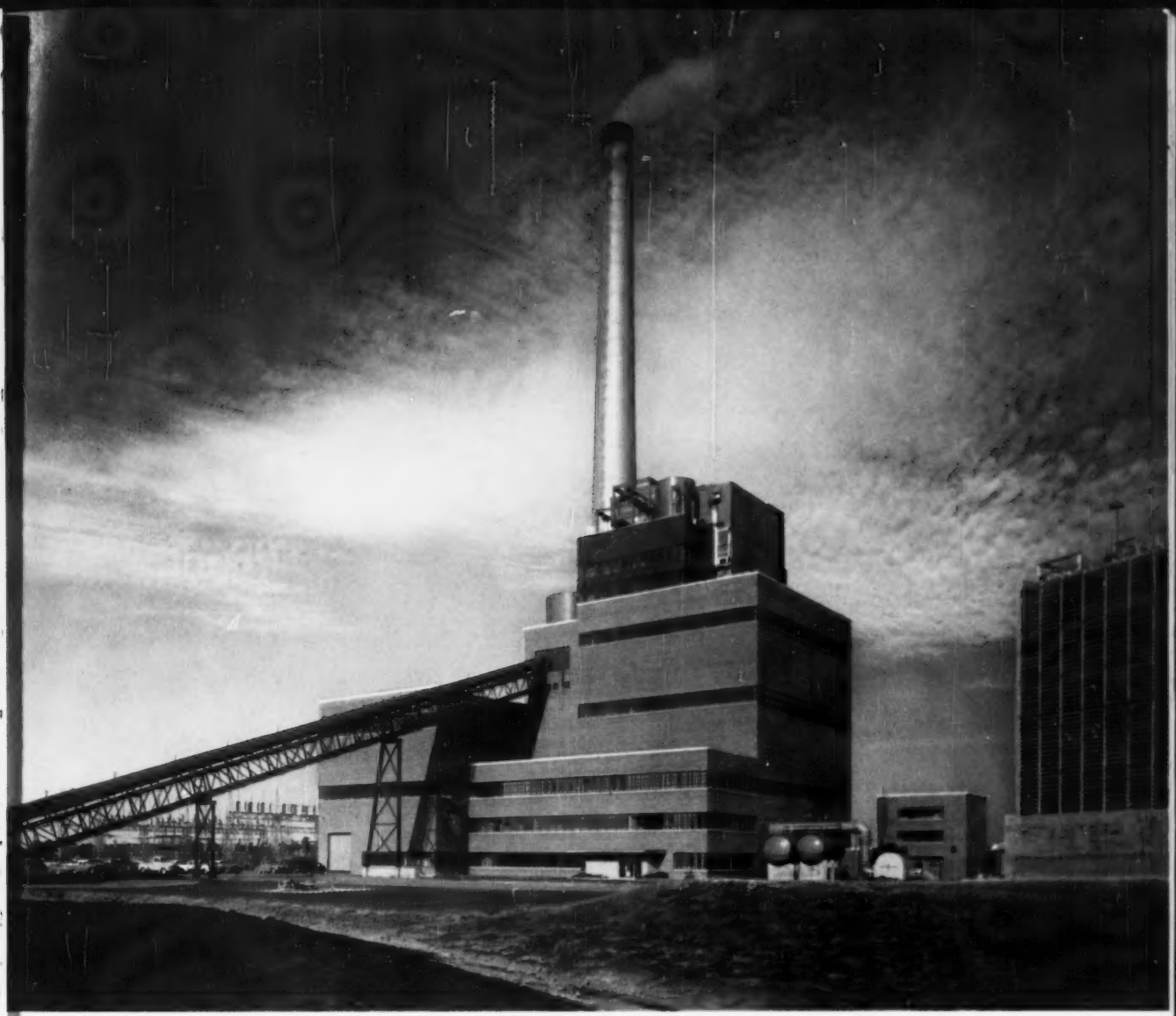
BUFFALO FORGE COMPANY

Buffalo, New York

Buffalo Pumps Division • Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING



E. W. BROWN GENERATING STATION KENTUCKY UTILITIES COMPANY 100,000 kw—1 Unit

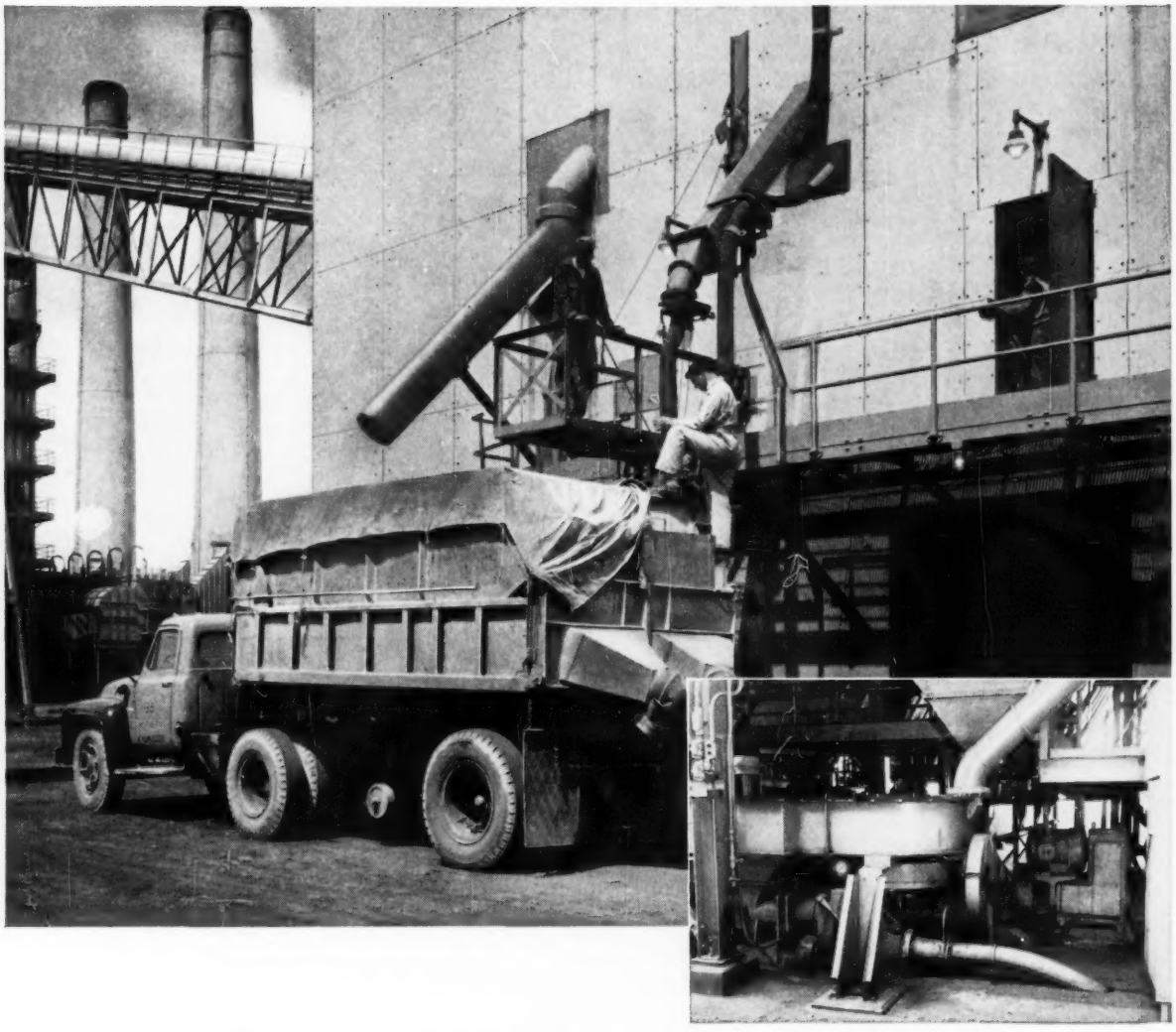
Power in Kentucky . . .

10,000 square miles of Kentucky, including the magnificent Blue Grass region, is served by Kentucky Utilities Company. Among its many commercial activities are Thoroughbred breeding and racing, burley tobacco, distilling, extensive coal mining, and cattle raising. New industry is extensive and thriving. Kentucky Utilities Company is meeting an ever increasing need for power not only with the E. W. Brown facility, but also with a 100,000 kw unit placed in operation in mid 1959 at the company's Green River Power Station. These developments bring into sharp focus the company's motto "Helping Kentucky Grow."

FULL COLOR BROCHURE outlining the scope of Sargent & Lundy services will be sent on request.

SARGENT & LUNDY
ENGINEERS

140 SOUTH DEARBORN STREET, CHICAGO 3, ILLINOIS



Public Service Electric and Gas Co. Turns Fly Ash Problems Into Profit

By using Fuller pneumatic conveying systems, the Sewaren Generating Station of Public Service Electric and Gas Company, New Jersey, was able to collect 4100 tons of fly ash during 1957. Not only did this eliminate a serious disposal problem that formerly contributed heavily to operating costs . . . it also gave the utility which sold the collected fly ash, a new and valuable source of income.

The Fuller-Kinyon system at Sewaren collects and carries the fly ash to two storage silos that have a combined capacity of 380 tons. It is then either bagged in 50-lb. lots or transferred in bulk through a Fuller loading-out silo spout to tank trucks or covered dump trucks. Labor and equipment costs are kept at a minimum. Dusting is avoided, and high tonnages are handled easily over considerable distances. Extra handling flexibility is provided by a Fuller two-way diverting valve that permits unsuitable fly ash to be pumped directly to an ash reject tank instead of to storage.

Fuller pneumatic conveying systems can be installed almost anywhere at minimum costs, regardless of plant conditions. Moisture and dirt cannot enter the system and material cannot escape. Write today for detailed information in Bulletin FF-49-1. 1334 G-202

Fuller
pioneers in harnessing AIR

FULLER COMPANY
173 Bridge St., Catasauqua, Pa.
Subsidiary of General American Transportation Corporation
Birmingham • Chicago • Kansas City • Los Angeles • New York • San Francisco • Seattle

FULLER COMPANY GENERAL AMERICAN TRADE MARK

The Electrical Week

LATE NEWS ▶

Washington Wire . . . FPC orders N. Y. State E&G to show cause why it shouldn't be found guilty of violating Uniform System of Accounts for listing $8 million tax deferred as "earned surplus" . . . Sen Moss (D-Utah) writes Interior Secy Seaton asking (1) for comments on Nov. 30 article in EW outlining five-state transmission system; (2) for a report on proximity of proposed private utility lines to load centers of preference customers; and (3) that Interior make no commitments on the proposed transmission system "until a full disclosure of its plans is submitted to the Senate Committee on Interior and Insular Affairs." The plan had been previously filed with Bureau of Reclamation (EW, Oct. 12, 1959, p 88).

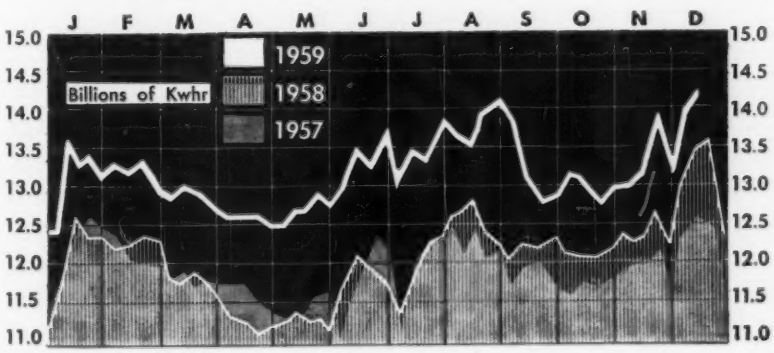
Study of Memphis LG&W rates recommends following increases: residential—19.9%; small commercial—18.2%; large commercial—17.9%; and industrial (5,000 kw or more)—11.9%.

Five utilities plan $250,000 study to cut A-waste costs. The five are Commonwealth Ed, Detroit Ed, Consolidated Ed, Northern States Power, Yankee Atomic, and W. R. Grace & Co's Davidson Chemical Dvn.

Around the States . . . Oregon Water Resources Board to open hearings Jan. 5 on PNP bid to build high Mountain Sheep Dam . . . Vermont PSC to take Vermont Electric Power to court to force it to seek PSC approval of purchase of 50,000 kw from Niagara Mohawk . . . Indiana & Michigan strike ends with 4½% wage hike, same offer originally made by company . . . Tacoma City Light will up rates for six big industrial customers 7½% on Jan. 1 . . . TVA and Tennessee Valley Trades and Labor Council agree on 4.37% wage increase.

Management changes . . . Con Ed elects J. E. McCormack Jr vp . . . D. B. Mansfield becomes exec vp at Ohio Ed . . . Superior Cable elects J. L. Robb president.

WEEKLY POWER OUTPUT—Up 4.6% (Week ending Dec. 19), Kwhr 14,150,000,000



Per Cent Change From Previous Year

	Dec 5	Dec. 12	Dec. 19
Total U. S.	+ 6.8	+ 5.3	+ 4.6
New Eng.	+ 3.0	+ 2.9	+ 2.1
Mid. Atlan.	+ 4.9	+ 4.7	+ 4.6
Cent. Ind.	+ 6.7	+ 5.6	+ 5.3
West Cent.	+ 4.6	+ 1.7	+ 0.7
Southeast	+ 9.4	+ 4.1	+ 2.2
South Cent.	+ 8.7	+ 7.3	+ 7.7
Rocky Mount	+ 2.0	+ 0.7	+ 0.9
Pacific			
NW	+ 4.6	+ 8.4	+ 5.1
SW	+10.6	+11.7	+11.3

Seasonally Adjusted Index 259.3

Week Ago 261.4 Year Ago 247.6

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **The decade ending this week has been one of solid accomplishment** for the Electric Utility Industry. Steady growth characterizes a 10-year balance sheet and dramatic progress is evidenced by engineering and technical advances **(p 58)** . . . As for 1959, EEI Pres Allen King's report reflects the increasing emphasis on comparative productive capacity of the U. S. and Russia. The Soviets will not catch up in the "foreseeable future," he says **(p 60)** . . . On the Legislative front, new emphasis is expected in 1960 on water resources and interconnections as a result of studies to be submitted to Congress. Approval of the $54-million Hoosier co-op loan bid is expected **(p 61)**.

ENGINEERING ▶ **Characteristics of today's 50 ac network analyzers** in the U. S. and Canada are summarized to show their continuing importance in system design **(p 64)** . . . At two large substations, where water supply for fighting fires is limited, American Electric Power has installed deluge-type systems, which are adaptable to expansion for guarding additional equipment **(p 66)** . . . Overhaul time on some OCB's is halved by Ohio Power's new method of removing carbon deposits with pressurized oil **(p 87)** . . . Untying and re-sagging old conductor prior to bundling it with a new one gives a more satisfactory sag. This was done on a Southwestern Public Service 115-kv line **(p 88)**.

Politics and Public Power

THE MEMPHIS BLUES

The wails coming out of west Tennessee these days over the authorized 20% rate hike for Memphis Light, Gas & Water Division sound not a little unlike the ones that came out of that neck of the woods three years ago over the "sell-out," "give-away," and "unconscionable deal" (as Sen Kefauver put it) that was the Dixon-Yates contract. And, to some extent at least, it's the same folks who are doing the wailin'.

What must be especially satisfying—if not downright amusing—to the people who favored the Dixon-Yates contract is the recollection that it provided for power to be fed into the TVA system at or near Memphis at a 25-year guaranteed rate.

It must be assumed that it is equally embarrassing to those who opposed it "in the public interest." It is impossible to say, however, because most of them are silent about it.

The reasons given by Memphis LG&W for the increase are three: (1) A drop in revenues to $26 million from an anticipated $34.7 million, caused by the 1957-58 recession; (2) An increase in the interest on bonds from 3% to 4.4%, putting total interest some $2 million above estimates; and (3) Diversion of a $4-million-per-year depreciation fund to cover borrowing costs. Net result: Memphis LG&W figures to fall short of expected funds by about $14.7 million.

This contrasts with the reasons given in an editorial in the Memphis Commercial Appeal which says that "Any comparison between the proposed Memphis increase and TVA rates would be specious because where rising coal and labor costs are chiefly responsible for the action to be taken here, TVA faces the seem-

PROCUREMENT & PRODUCTS ▶ **Some signs of heavy electrical equipment price stability** are showing up . . . Prices on basic aluminum move up **(p 92)** . . . Insulation industry discusses latest and future trends at second annual National Conference on Application of Electrical Insulation **(p 96)** . . . Reel carrier accommodates reels up to 62 in. in width . . . Alarm/control system monitors and controls unattended locations . . . Transformer for residential underground use is pad-mounted, and features high and low-voltage compartments separate from the transformer **(p 108).**

MANAGEMENT **Utilities can help their local schools in many ways,** says a booklet just published by Edison Electric Institute. But utilities don't always know the best way to go about offering their aid. Here are some guidelines, laid down by EEI, after consultation with power companies and the National Education Association, to help your company organize its educational aid program **(p 123).**

SELLING ▶ **Medallion Homes are still going over big with utilities** and builders, recent promotions at Illinois Power and Southern California Edison indicate **(p 127)** . . . New York City may require property owners to light their building fronts if bill introduced to City Council becomes law. Aim is to cut crime **(p 130).**

ing inevitability of a rate increase because of the character of the self-financing provisions authorized by the last Congress. The matter of which increases first . . is purely academic."

Judging from the outraged letters being printed in the Commercial Appeal, however, the citizenry of Memphis regard the matter as anything but academic. Again and again, they protest the increase, saying that city officials didn't keep their promises, calling in some cases for punishment of MLG&W officials, and pointing to the lower rates they say they would have enjoyed had Memphis remained in TVA . . . as indeed, they might have, had the Dixon-Yates contract been allowed to remain in force. For while the power sold under it by Mississippi Valley Generating Co to TVA would have been to meet the demands of the Atomic Energy Commission, it also would have released TVA capacity to meet the growing needs of the Memphis area.

Many of the citizens of Memphis—and presumably their political representatives—are learning that the costs of being in the power business for themselves are higher than they realized. And it may be that some of them now are privately regretting their actions in making the Dixon-Yates contract the political football it became. They might even be pondering the words of Sen J. W. Fulbright, certainly no foe of TVA and public power, when he said in the Senate: "A careful analysis of the Dixon-Yates contract as against the TVA 'yardstick' shows that it compares very favorably with TVA performance. This, of course, assumes that we still believe there is a place in our economy for commercial enterprises which pay federal and state taxes, and which do not have access to the Federal treasury for capital funds."

Executive Reader

Solderless wrapped connections will perform satisfactorily for 40 years in central office service if properly designed and made, assures laboratory studies and field experience. The use of solderless wrapping in the Bell System now amounts to several hundred million connections wrapped annually. **S. J. Elliot, Monograph 3339, Bell Telephone System Technical Publications.**

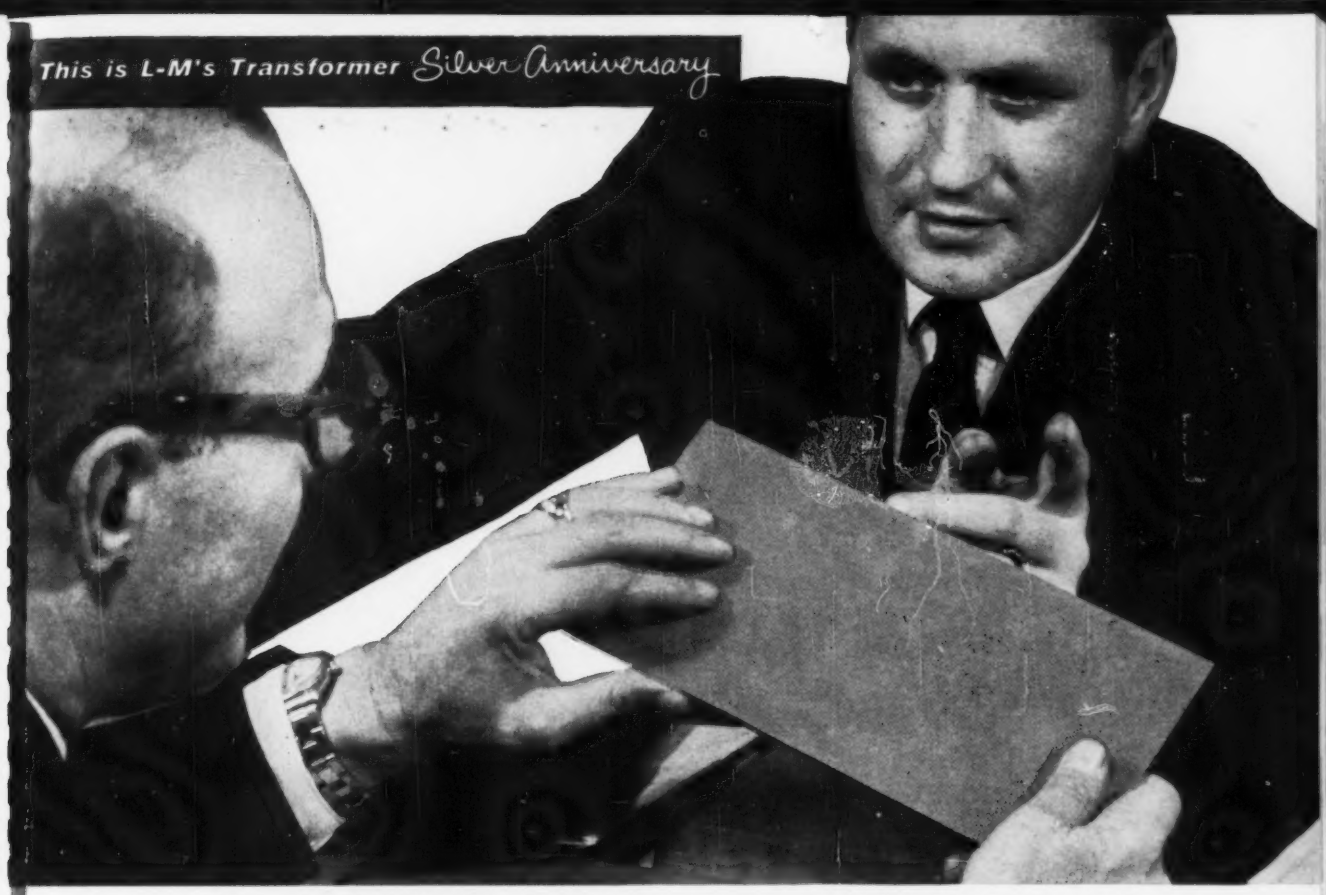
A miniature data printer using electro-sensitive paper may replace the electric typewriter as an output component in electronic data processing systems. The printer, smaller than a cigarette package and weighing only a few ounces, requires very little operating power and can print up to 20 digits simultaneously. **New York University, Office of Information Services.**

Electric life insurance against accidental death in the home from electricity furnished by the rural cooperative is offered by Hancock-Wood Electric Cooperative, North Baltimore, Ohio. The policy covers every co-op member, his family or any person visiting his premises to the extent of $2,000 for an adult and $1,000 for a person under 19. Cost to the co-op is one cent per meter per month, with this rate expected to drop in a few years. **Rural Lines, December 1959, Rural Electrification Administration.**

Leakage current surges on dc high-voltage circuits occur across contaminated insulators just as they do on ac circuits. Predominating factors in a test of 115-kv dc outdoor line and station insulation appear to be the various surface heating and drying effects. About 30% more insulation seems to be required for a dc circuit than for an ac circuit of the same peak voltage. **Electrical Review, November 20, 1959.**

English abstracts of newly-published Russian patents now are available from a British firm on a monthly basis. Price of a year's subscription for the "Russian Patents Gazette, Comprehensive" is $120. For the "General, Mechanical, & Engineering Section" only, or for the "Chemical & Chemical Engineering Section" only, the price is $80. **Technical Information Co, Chancery House, Chancery Lane, London WC2, England.**

A two-way radio in a safety hat has a sound-cancelling microphone for effective transmission when surrounding noise level is high, reports Dowell Division of Dow Chemical Co. The radio, about the size of a cigarette pack and weighing 2 lb including two small batteries, has a 1,000-ft range. **Petroleum Week, November 6, 1959.**



YOUR L-M FIELD ENGINEER is anxious to discuss the numerous qualities of the new, safe, durable Levroc coating. Ask the Field Engineer to show you this sample of Levroc-coated steel.

New L-M Levroc™ Transformer Coating Reduces Outages, Improves Continuity

New thermoplastic cellulosic coating on transformer covers combines high dielectric strength and excellent protection against weather.

by **A. R. WAEHNER**
Director
Transformer Product Sales
Line Material Industries

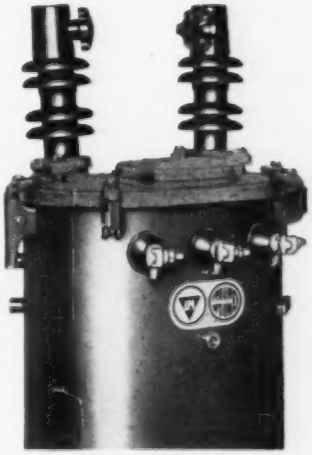
Line Material Industries will apply a new cellulosic coating, Levroc*, on all Round-Wound® distribution transformer covers above 5 kv. This new ice-blue-colored coating combines high dielectric strength with excellent weather resistance, thus reducing outages caused by birds and squirrels.

Levroc is especially formulated for the dual role it plays. It completely coats and adheres to the surface it protects. Since it is applied by the fusion bond process, over a special primer, Levroc coats all edges, corners and projections with equal thickness. It is unaffected by the texture and contours of the surface it coats. It provides an extremely smooth surface, free of all sags, pock marks or drip marks.

This smooth coating is impervious to moisture, salt spray, oil, and grease. It has high scratch resistance and is virtually chip-proof. Levroc is tough, but not brittle.

Get Complete Information

Your L-M Field Engineer has samples of this new coating. Learn how Levroc provides safety to your system and protection to the transformer. Call your L-M Field Engineer or write me at Line Material Industries, Milwaukee 1, Wisconsin.



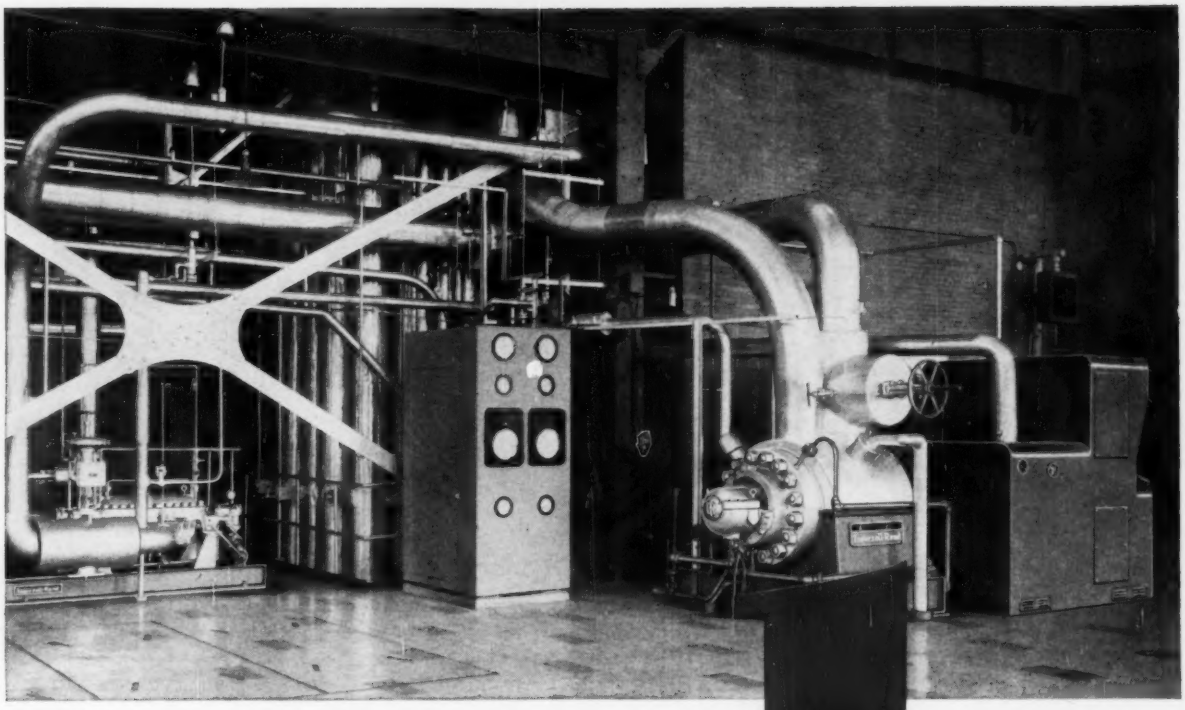
THE LIGHT BLUE COLOR of the Levroc coating clearly distinguishes it from painted transformer covers.

**Levroc coating available for entire transformer tank at slight extra cost.*

LINE MATERIAL Industries Distribution Transformers
McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

430



FULL-CAPACITY PUMPS... ONE per boiler

I-R High-Speed Boiler-Feed Pump at Appalachian Power Company's Glen Lyn Station is the first of 8 Identical I-R Units installed on the American Electric Power System

The Ingersoll-Rand boiler-feed pump shown above represents a radical departure from previous central station practice. Instead of the usual three-pump arrangement with two normally carrying full load, in this installation one main pump supplies all the feedwater required for the 225 MW Glen Lyn Unit No. 6. This unit first operated in May 1957. The last of seven more I-R full capacity boiler-feed pumps like the one shown above is currently being installed.

In addition to making important savings in first cost and operating cost, the turbine-driven full-capacity pump improves cycle performance and heat balance conditions by using extraction steam from the main turbine to drive the pump and exhausting this steam to feedwater heaters.

Each pump, rated 1,500,000 lb/hr at 2400 psig and 5400 rpm, is driven directly by a General Electric turbine. Pumps are of 4-stage, double-case construction with "Unit-Type" rotor assembly and floating-ring type stuffing boxes. Boiler start-up is handled by a smaller auxiliary motor-driven I-R feed pump, barely visible in the left background above.

In addition, American Electric Power will soon put into operation the *world's largest* boiler-feed pumps—two 22,000 hp I-R full capacity units serving new 450 MW generators at two AEP stations.

For further details on full-capacity boiler-feed pumps, or any other boiler-feed units, contact your Ingersoll-Rand sales engineer.

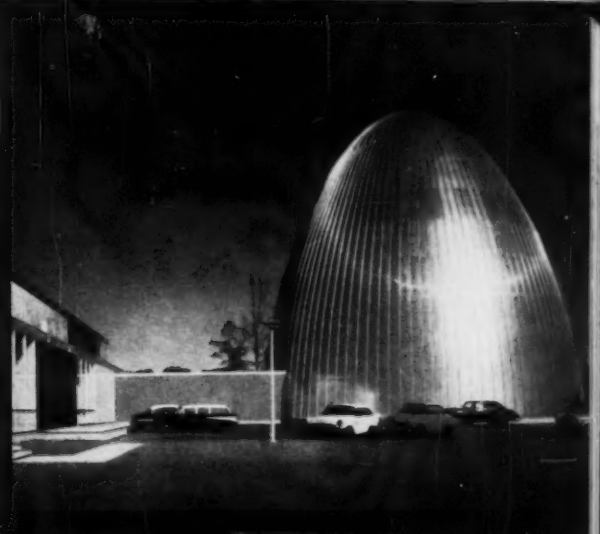
Ingersoll-Rand
10-906 11 Broadway, New York 4, N. Y.

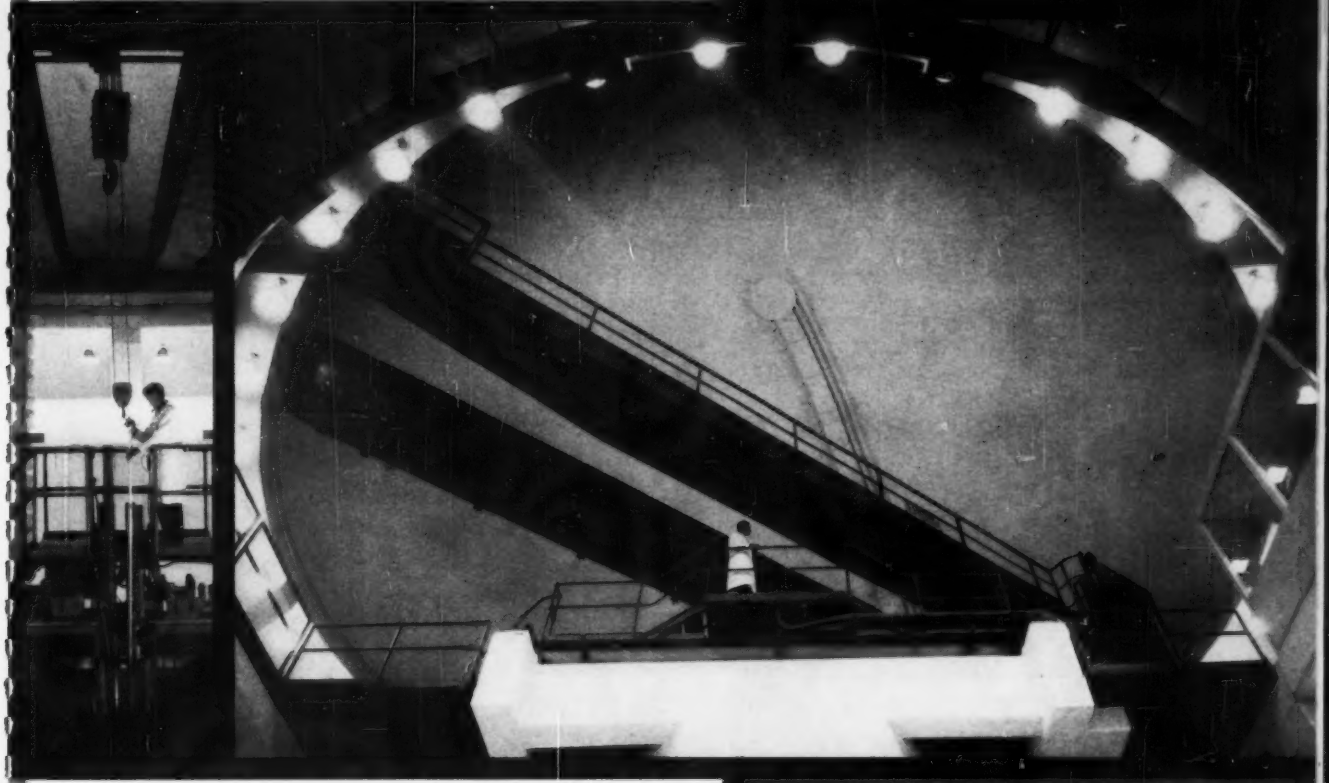
COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS
CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS

Holophane Lighting

Keeps Pace with the Advances of Industry

SKIDMORE, OWINGS & MERRILL, Architects
GUY B. PANERO ENGINEERS, Cons. Engrs.
EMERSON-GARDEN ELECTRIC CO., Contractors





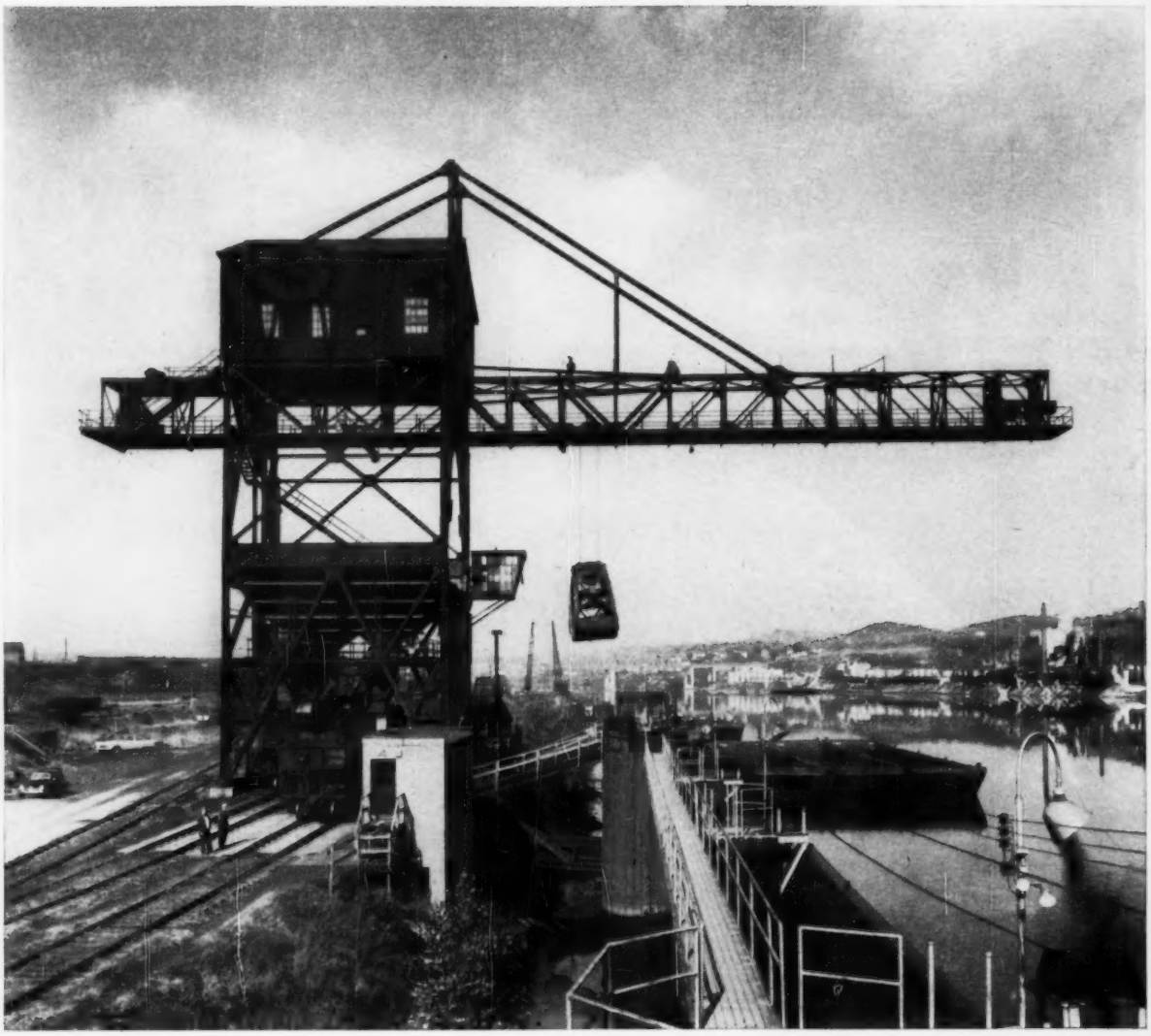
LOBAY Mercury Reflectors Light Industrial Reactor Laboratories

Twelve important companies have coordinated their resources for experimenting with nuclear radiation in industry at Industrial Reactor Laboratories, Plainsboro, N. J. . . . HOLOPHANE LOBAY Prismatic Reflectors were selected to light the pool reactor area because they provide many unique advantages. Their deep shielding prevents reflection from the pool. Prismatic design produces high level illumination with low brightness. At the same time, their upward component affords balanced, overall luminosity. Excellent light distribution permits best control of the reactor in the shaft . . . One more example of the way that HOLOPHANE controlled lighting meets specific needs.

Holophane
No. 635
LOBAY

HOLOPHANE
COMPANY, INC. • *Lighting Authorities Since 1898*
342 Madison Ave., New York 17, N.Y.
THE HOLOPHANE CO., LTD., 418 KIPLING AVE. SO., TORONTO 18, ONTARIO

You are invited to consult HOLOPHANE engineers through your professional advisors.



Nearly 30 million tons of coal have been unloaded by this Dravo unloader. It was built in 1932 for the Pittsburgh & Lake Erie Railroad. In all these years of service no more than routine maintenance has ever been required. In 1957, the last year of full steel production, this machine unloaded approximately 1,500,000 tons. It is a good example of the kind of bulk materials handling equipment Dravo builds: efficient, long-lasting, economical. Find out more. Contact DRAVO CORPORATION, PITTSBURGH 25, PENNSYLVANIA.

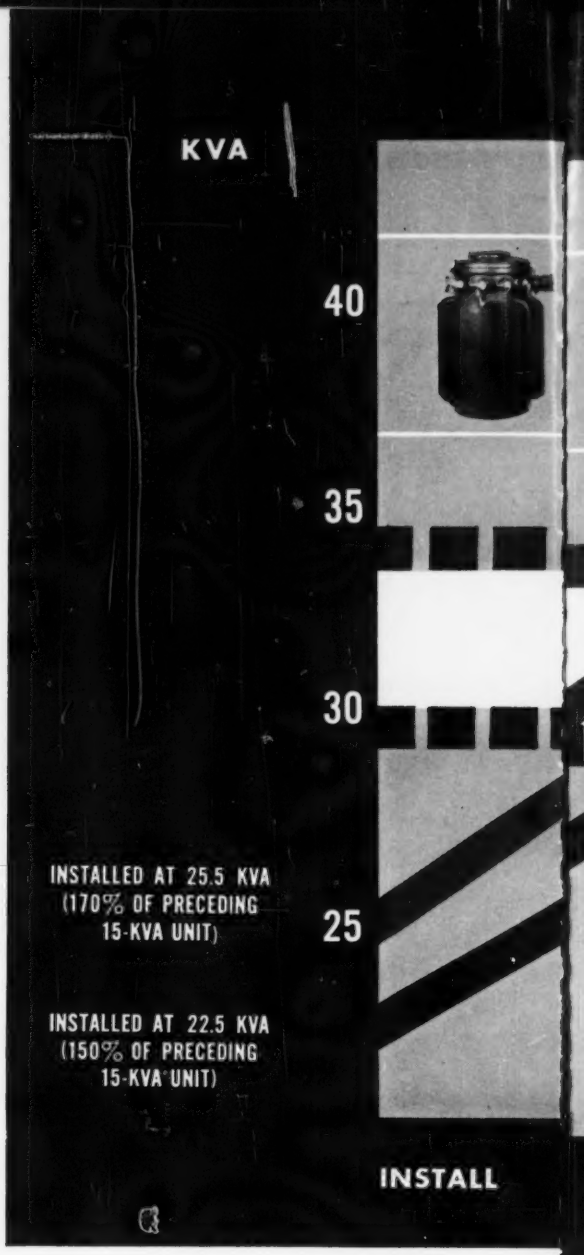
DRAVO
CORPORATION

ARE YOU TAKING ADVANTAGE OF THE $ SAVINGS NOW POSSIBLE WITH GENERAL ELECTRIC DISTRIBUTION TRANSFORMERS?

GENERAL ELECTRIC

NEW GENERAL ELECTRIC TRANSFORMER with Permalex* insulation increases loadability by 20 percent with no loss in operating life!

With
General Electric
Distribution
Transformers

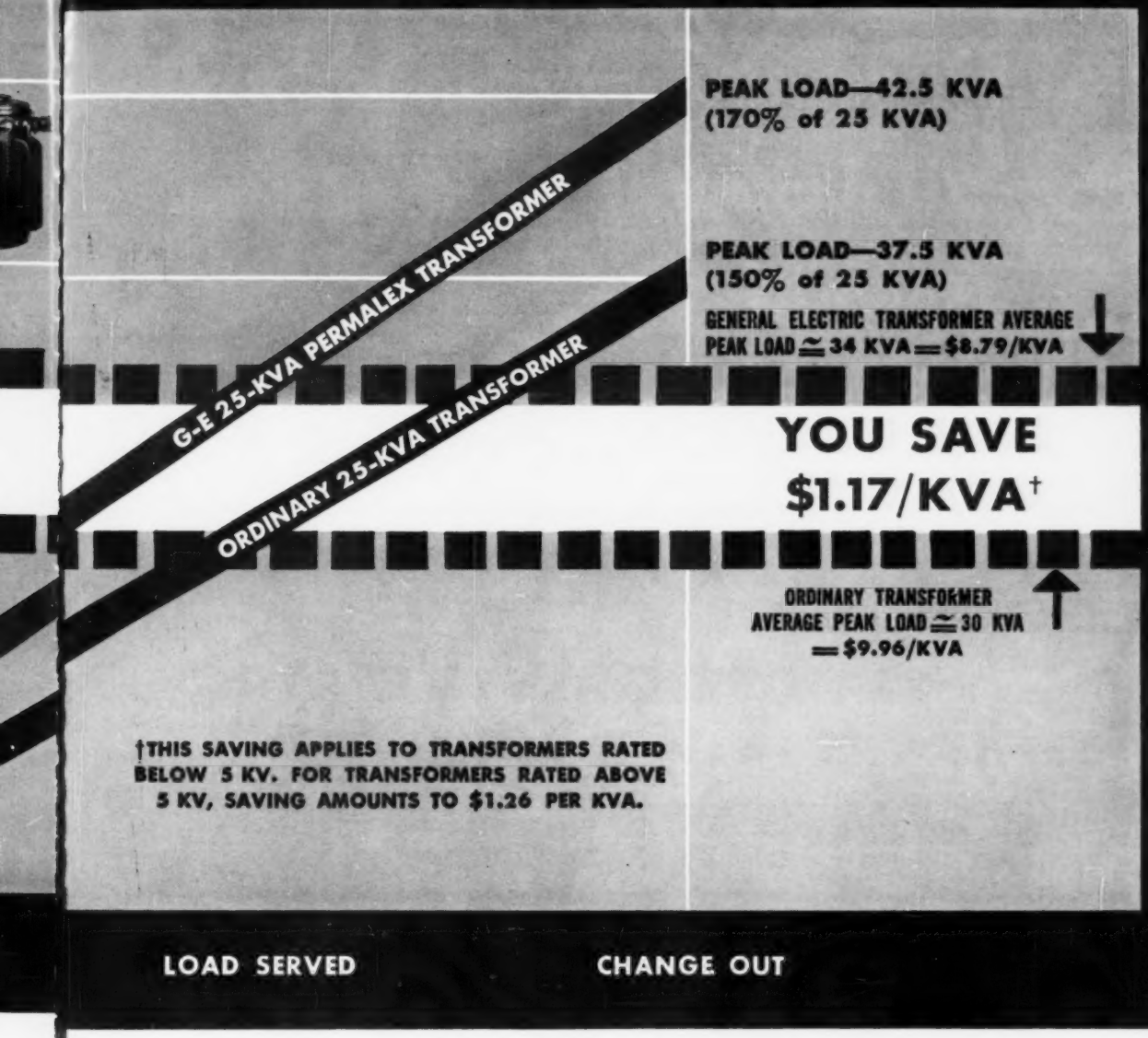


20% Higher Loadability Cuts Transformer Costs Per KVA Of Load Served

New Permalex insulation saves $1.17 per KVA with a 25 KVA transformer.

*Trade-mark of the General Electric Co.

You get these savings with G-E 25-KVA Permalex transformers


PEAK LOAD—42.5 KVA
(170% of 25 KVA)
PEAK LOAD—37.5 KVA
(150% of 25 KVA)
G-E 25-KVA PERMALEX TRANSFORMER
ORDINARY 25-KVA TRANSFORMER
GENERAL ELECTRIC TRANSFORMER AVERAGE
PEAK LOAD ≃ 34 KVA = $8.79/KVA
YOU SAVE
$1.17/KVA†
ORDINARY TRANSFORMER
AVERAGE PEAK LOAD ≃ 30 KVA
= $9.96/KVA
†THIS SAVING APPLIES TO TRANSFORMERS RATED BELOW 5 KV. FOR TRANSFORMERS RATED ABOVE 5 KV, SAVING AMOUNTS TO $1.26 PER KVA.
LOAD SERVED
CHANGE OUT

General Electric's new distribution transformers through 167 kva handle up to 20 percent greater overloads—with full operating life. This added loadability can reduce your transformer investment per kva of load served. Here's why:

On the average, transformers are changed out when peak load reaches 150 percent of rated load. With Permalex insulation in General Electric's new transformers, you can reach 170 percent of rated load before changing out.

As shown in the example above, a 15-kva transformer would normally be changed out when peak load reaches 22.5 kva. A 25-kva unit would then be installed and used until the load increased to 37.5 kva. The average peak load on this ordinary transformer would be 30 kva. Since the net price of a 25 kva, conventional, no tap, transformer below 5 kv is $299, the resultant cost is $9.96 per kva of load served.

With General Electric's 20 percent added loadability, a 15-kva transformer would be used until the peak load reaches *25.5 kva.* A 25-kva unit would then be installed and used until the load reached *42.5 kva,* or 170 percent of rated load. The average peak load of the G-E transformer would then be 34 kva. Again, since the price of the 25-kva transformer is $299, the resultant cost is $8.79 per kva —or a saving of *$1.17 per kva of average peak-load capacity over ordinary transformers.*

Are you taking advantage of this dollar-saving opportunity? For complete information on how you can make Permalex insulation pay off, contact your G-E Sales Engineer, or write for bulletin GEA-6070 to Sect. 431-89A, General Electric Co., Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Bristol Dynamaster* Electronic Instruments have proved themselves in thousands of installations. They fully meet today's most exacting standards of accuracy and dependability. They measure almost any variable that can be translated into an electrical quantity (d-c current, d-c voltage, resistance or capacitance). Just a few are: temperature, pH, speed, voltage, smoke density and strain.

Here are some outstanding features that make them ideal for industrial plants, pilot plants, and for research, test, and laboratory use:

1. Continuous standardization—eliminates standardizing mechanism and dry cell—no interruption to control. **But retains precision standard cell for highest accuracy and stability.**

2. Simple design—few moving parts.

3. Easy to use and service—little or no maintenance required.

4. Rugged construction—unaffected by vibration.

MODELS FOR EVERY PURPOSE. Dynamaster Instruments are now available as:

A. Single-pen, two-pen, and multiple-record (up to 24 points) strip-chart instruments.

B. One- and two-pen round-chart recorders.

C. High-speed recorders (0.4 second).

D. X-Y recorders.

E. Extended range recorders.

F. Adjustable span and zero recorders.

G. Miniature 3-inch strip-chart recorders.

H. Electric controllers in both strip- and round-chart models—all types of control action and as time-program control.

I. Pneumatic controllers in both strip- and round-chart models—all types of control action and time-program control.

J. Instruments for electronic measurement—pneumatic transmission of reading by 3-15 psi signal.

K. Round chart program controllers.

L. Telemetering transmitters.

M. Drum-type precision indicators.

N. Multi-bank recorder—will accept up to 200 separate inputs and record them on 12-inch wide strip chart.

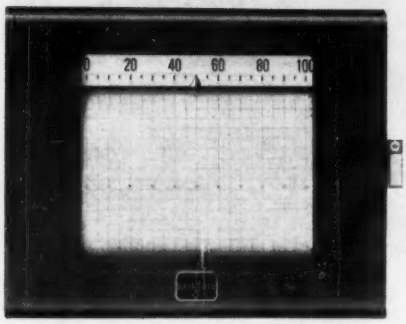
O. Relay-rack mounting models—most models available in case that fits standard 19" relay-rack without modification to instrument or rack, without panel-cutting or masking.

Bristol Dynamaster Potentiometer and Bridge Instruments can be equipped with analog-to-digital encoders of various types for digital readout and computer use. For complete details, write for Bulletins P1245A, P1270, P1271, P1242, and P1282. The Bristol Company, 116 Bristol Road, Waterbury 20, Conn.

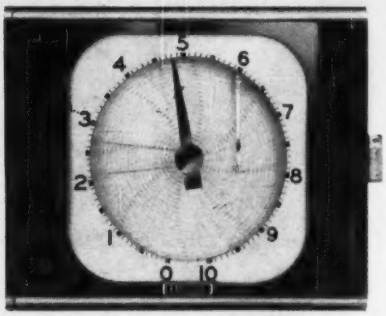
*T. M. Reg. U. S. Pat. Off.

look to Bristol for the complete line of

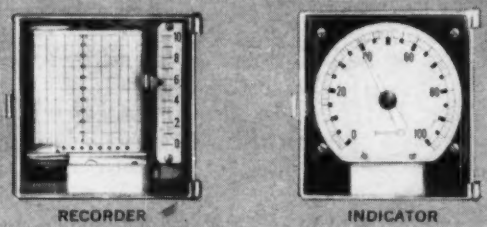
ELECTRONIC POTENTIOMETER and BRIDGE INSTRUMENTS



Dynamaster* Electronic Potentiometer or Bridge—records on 11-inch, 120-foot-long strip chart.



Dynamaster* Electronic Potentiometer or Bridge—records on 12-inch round chart, indicates on extra-large scale.



RECORDER INDICATOR

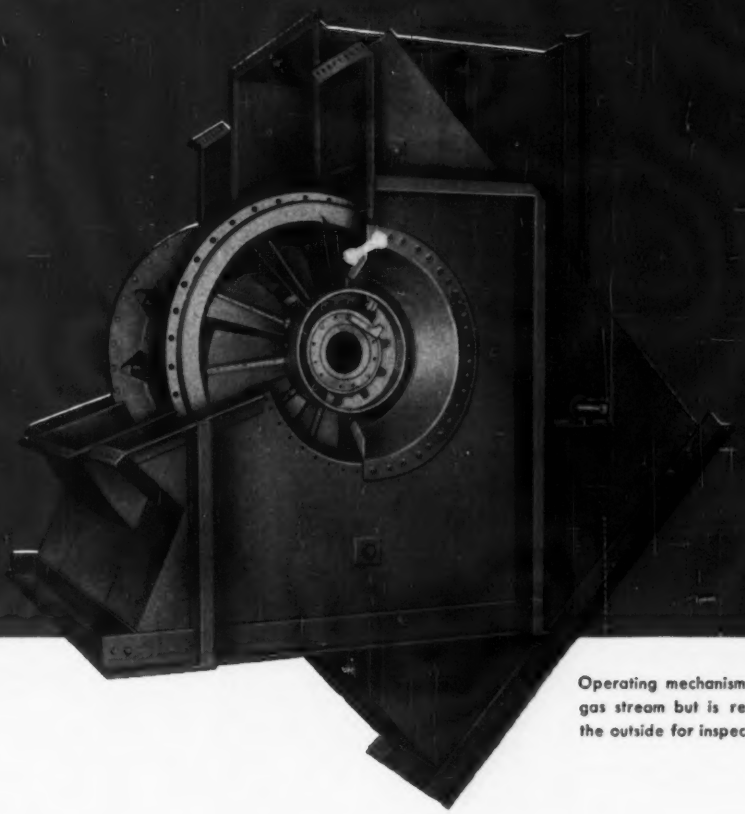
Plug-in Miniature Electronic Dynamaster Potentiometer and Bridge instruments—Only 5" x 5⅛" panel dimensions; ideal for graphic panel instrumentation.

BRISTOL

TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Westinghouse Volume Control helps pay off fly ash dust control investments



Operating mechanism is shielded from the gas stream but is readily accessible from the outside for inspection and maintenance

Westinghouse inlet vane air spin control is a *proven* low cost method of regulating Induced Draft fan output when using dust arrestors.

Many major power producers are using Westinghouse Inlet VANE CONTROL® on coal-fired induced draft fan applications, paying off their investment in dust control. Ask your Sturtevant Division Sales Engineer for a list of their names and installations — or, write Westinghouse Electric Corporation, Hyde Park, Boston 36, Mass.

PLANTS AT HYDE PARK, MASS., LA SALLE, ILL., BERKELEY, CALIF.

YOU CAN BE SURE... IF IT'S Westinghouse

Watch "Westinghouse Lucille Ball-Desi Arnaz Shows" CBS-TV Fridays

J80697

experience

keeps BICC *in the lead*

134 countries can't be wrong —

Last year the BICC Group traded in 134 countries. We supplied cables, conductors and accessories for every electrical purpose, and sales amounted to $310,800,000. Why such a demand? Well, we're not only the World's biggest cablemakers; we're the most experienced too. Here are some of our recent developments.

The DSO cable

—designed for economy

The Ductless Shaped-conductor Oil-filled cable is BICC's latest development in 33kV transmission. Dispensing with fillers and built-in ducts, the design means economy in materials and manufacture. Consequently, costs are lower. The advantages of D.S.O. Cables were quickly recognised. They have already been ordered for a number of installations in Britain and South Africa.

CABLES FOR THE FIRST NUCLEAR POWER STATION

BICC supplied cables and accessories for Calder Hall, England, the first nuclear power station in commercial operation. The cables included specially designed types resistant to intense radiation and heat, for operating the fuel charging and discharging grabs.

VANCOUVER POWER LINK

The 138kV Submarine Power Link between the British Columbia mainland and Vancouver Island required seven unjointed cables each 16 miles in length: the longest unjointed power cables ever! Although this project was considered to be impossible by the electrical world, BICC designed, made and laid the cables with conspicuous success. Altogether, $10 million worth of power cable contracts have been placed with BICC by the British Columbia Electric Co., Ltd.

330,000 VOLT CABLE FOR KARIBA

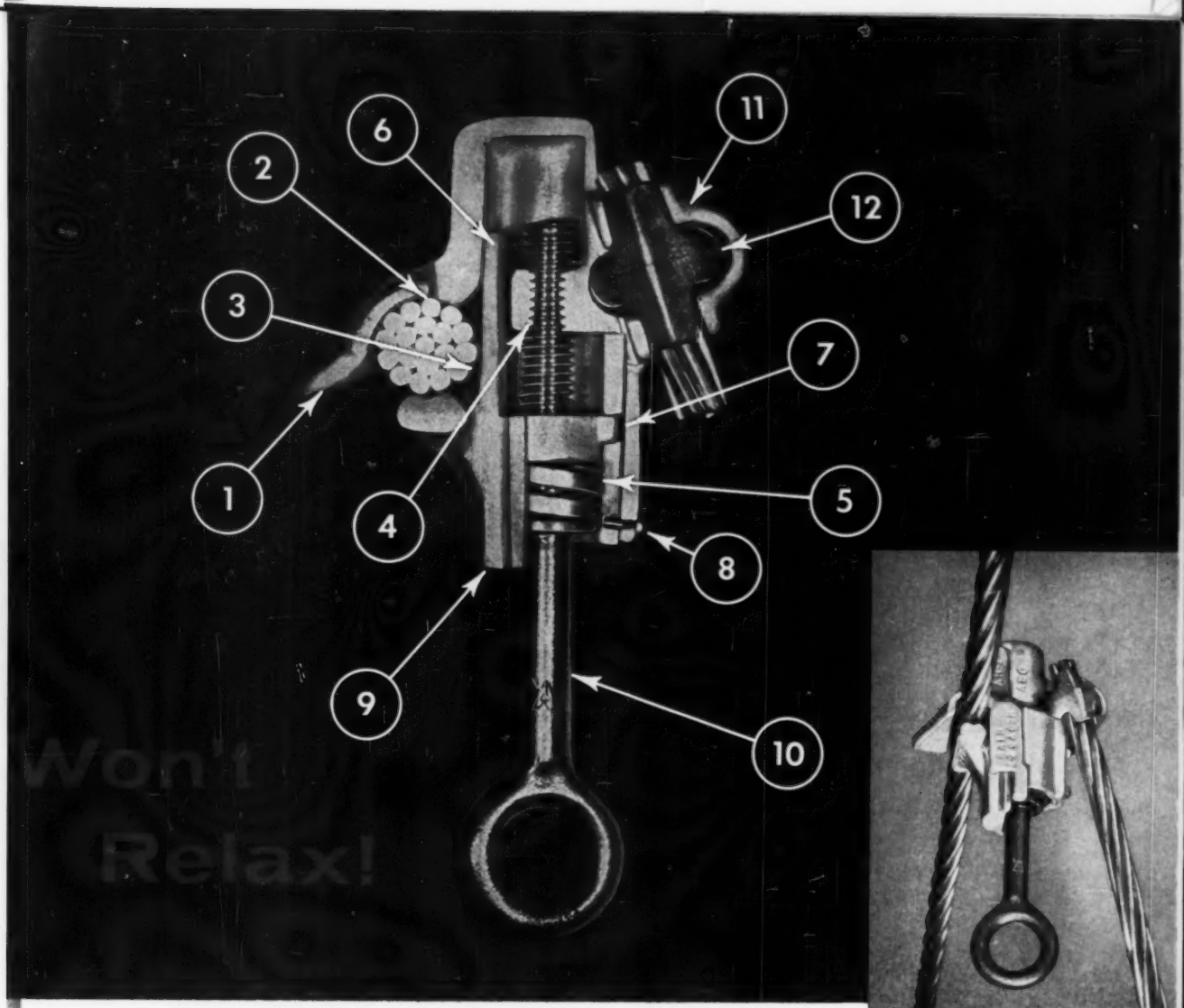
The Kariba Dam is being built on the Zambesi River to provide hydro-electric power for Central Africa.

Transmission equipment for this project is being manufactured by BICC. Altogether, orders for this Company total some ten million dollars and include a specially designed 330,000 volt single-conductor oil-filled cable which will connect the underground power house to the overhead transmission lines. This will be the highest voltage cable ever installed in Africa.

BICC the World's largest cablemakers

BRITISH INSULATED CALLENDER'S CABLES LIMITED

Technical Representative in U.S.A., Arthur F. Coventry, 11 West 42nd Street, Suite 442, New York 36, N.Y.



AH and BH Series Dura-TAP Hot Line Clamps

PATENT PENDING

Check the 12 features (shown above in cutaway view) of Anderson's new AH (aluminum) and BH (bronze) Dura-TAP hot line clamps. They're 12 sound reasons why you should specify these "won't relax" clamps for your next installation.

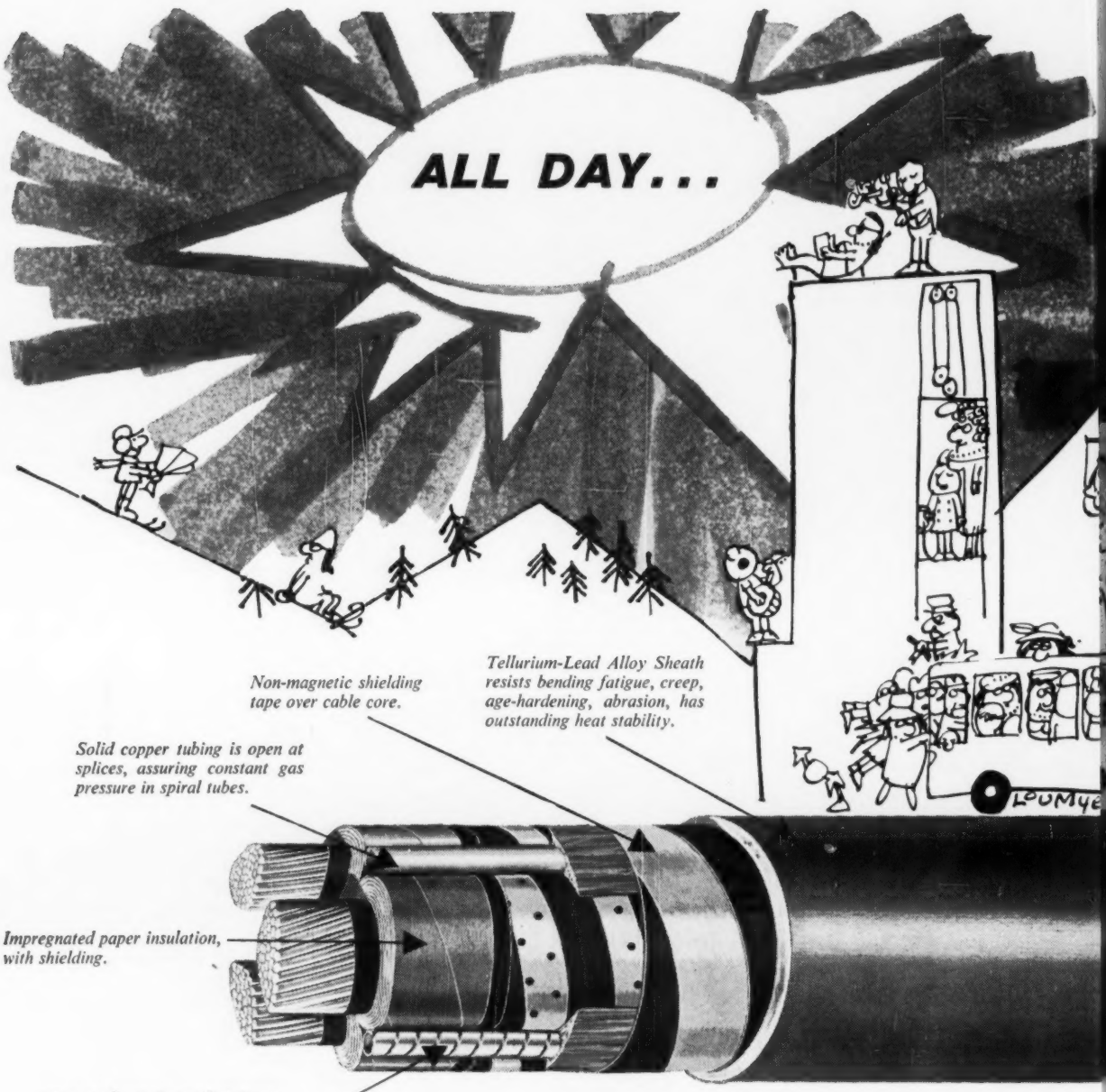
1. **Extended "beak" guides clamp onto conductor, minimizes arcing.**
2. **Semi-elliptical groove provides surer contact and wedging.**
3. **Special guide positions conductor in groove.**
4. **Protected threads—prevents freezing of moveable parts and "seizing" of threaded members.**
5. **High compression spring insures full contact at all times.**
6. **Exclusive keeper top rail rides under clamp body, prevents relaxing cantilever action on keeper.**
7. **Keeper guide lug maximizes keeper stabilization.**
8. **Retaining rivet prevents disassembly and interference during installation.**
9. **Extended body rail seats in any standard hot line stickhead.**
10. **Extra strong eyestem—will withstand Mercurous Nitrate test.**
11. **Eyebolt housing is part of main casting for minimum resistance.**
12. **Eyebolt designed to withstand seasonal cracking, stress corrosion.**

AH and BH each available in three sizes to cover all popular conductor ranges. AH may also be ordered plated for general purpose use.

ANDERSON ELECTRIC CORPORATION • BIRMINGHAM 1, ALABAMA

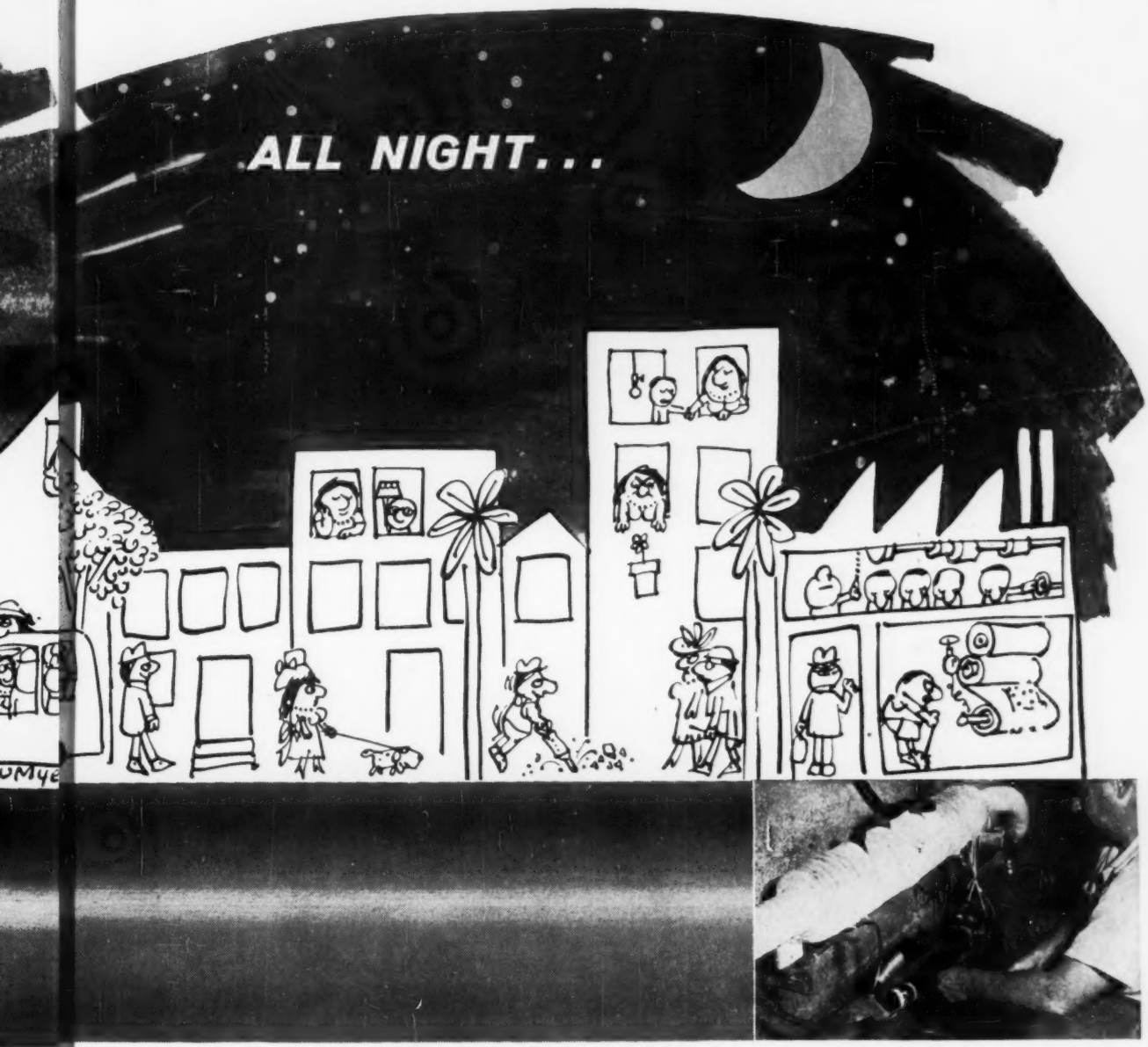
ANDERSON ELECTRIC

Research / Quality / Performance / in Aluminum and Bronze Products


ALL DAY...
Non-magnetic shielding tape over cable core.
Tellurium-Lead Alloy Sheath resists bending fatigue, creep, age-hardening, abrasion, has outstanding heat stability.
Solid copper tubing is open at splices, assuring constant gas pressure in spiral tubes.
Impregnated paper insulation, with shielding.
Two steel spirals conduct inert gas to all parts of cable to prevent ionization and provide self-supervisory properties.

ROEBLING GAS-FILLED CABLE

gives "no-outage" service ...without relying on luck!



THE SHEATH ON THIS CABLE . . . is one more reason why it's a best buy! The Tellurium-Lead Alloy Sheath offers the best possible resistance to fatigue and age-hardening problems . . . has 90% less creep, 4½ times greater bending life!

SIMPLE TO SPLICE—Roebling Gas-Filled Cable actually is as easy to splice as ordinary paper power cable.

How? Because it virtually can "look after itself!" This remarkable cable is self-supervisory. Inside it, super-dry nitrogen gas is present at approximately 12 p.s.i. pressure. When pressure drops below 10 p.s.i.—or goes above 16 p.s.i.—a "trouble" message is relayed to the nearest attended station. Because you know *immediately* when something's up, repairs can be made before further, and perhaps more serious damage occurs! What's more, should small holes develop in the splices or elsewhere, escaping gas *prevents* the entrance of killing moisture until there's opportunity to repair the cable!

ROEBLING GAS-FILLED CABLE, for voltages up to 46 kv, offers other advantages, also. The inert dry nitrogen gas provides consistent dielectric properties throughout the cable's length. It prevents ionization, too. This Roebling Cable is as easy to splice as solid-type paper power cable —and if your system's profile includes grades, it will prove the most inexpensive cable you've ever specified!

Our new Gas-Filled Cable book soon will be ready. It tells you the fine points of this wonderful cable . . . and its applications. Write for it today! Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

SOUTHERN STATES OFFERS THE MARGIN OF SAFETY NEEDED IN AIR SWITCHES TODAY AND TOMORROW

The switches shown here are brand new. They will pass any industry standard short circuit test with ease.

But what about 10 years from now, when the switches are covered by grime and grit; when operation has caused some wear of the contact surfaces?

What's going to happen *then*, when heavy fault currents occur? Are the critical current interchange points going to stand up to the task of protecting your valuable load?

These are questions that must be answered by engineers concerned with today's complex transmission and distribution problems. Basic switch design, quality of construction, and the type of contacts used deserve critical appraisal. The contact is most important.

Southern States provides extra security for its air switches by using Amplitact® contacts. Since this contact was introduced about 10 years ago, *not a single one has ever failed under short circuit.* This is the margin of safety you need.

Look beyond the catalog and technical data—look to the future capabilities and trustworthiness of the switch you buy.

High density, high load areas demand maximum protection against higher values of fault current. That is why so many utilities throughout the nation are using Southern States Air Switches with Amplitact Contacts.

Get the facts from your Southern States representative, or write direct for details.

SHORT CIRCUIT TESTS OF SOUTHERN STATES SWITCHES EQUIPPED WITH *AMPLITACT* ® CONTACTS

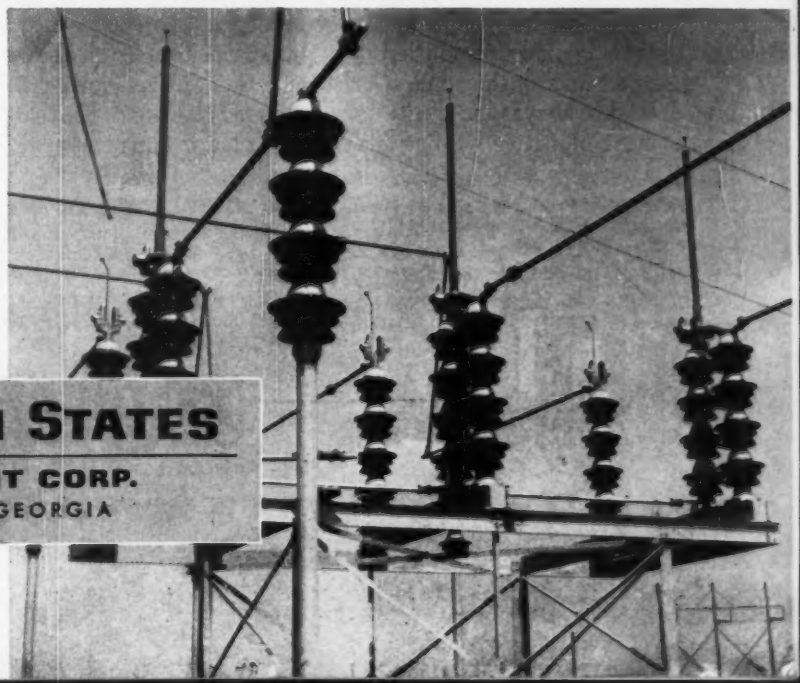
KEEP PACE ELECTRICALLY

KV	CONT. CURRENT RATING	TEST SHOTS			TEST RESULTS
		NO. OF TESTS	RMS AMPERES MAXIMUM	RMS AMPERES MINIMUM	
161	1200	12	62,900	51,200	No Damage
		6	79,000	60,000	No Damage
		6	80,300	69,700	No Damage
		9	84,500	74,600	No Damage
		9	98,000	78,400	No Damage
		3	106,800	89,800	Pressure Marks*
161	2000	7	70,500	58,600	Pressure Marks*
161	1600	8	70,000	53,700	No Damage
		1	114,000		Pressure Marks*
		6	82,000	65,300	Pressure Marks*
161	1600	5	106,100	99,500	Pressure Marks*

**The term "Pressure Marks" should in no way be construed as an indication of damage to the contact. Instead it points up the extremely high contact pressures which were developed by* AMPLITACT® *and were anticipated in the design of this type contact.*

ABOVE Consolidated Edison's Buchanan Substation is shown here during construction. Southern States' 161 KV—2000 amp Type RDC double side-break switches and 230 KV—1600 amp Type WAG switches (not shown) are the Amplitact equipped air switches used on this station.

AT RIGHT Houston Lighting & Power Company uses 161 KV—1200 amp Type WAG air switches on this modern substation.



SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA Dominion Cutout Co., Ltd., Toronto

Alabama Power Company

Boston EDISON Company

CENTRAL HUDSON

NIAGARA MOHAWK

PHILADELPHIA ELECTRIC COMPANY

KELLOGG'S FABRICATION-ERECTION SERVICES KEEP PACE

No designer-fabricator-erector of power piping has worked so closely with the industry as Kellogg to meet the increasingly more critical steam pressure/temperature requirements of the nation's electric utilities.

Long a leader in the application of the newer alloys, and in the development of better welding materials and welding techniques for the power generating industry, Kellogg is today privileged to announce more than a dozen projects concurrently executed with the *five* major utilities, listed above. Each of these major assignments includes the use of Kellogg's K-Weld® technique for welding the main steam and other critical lines, both in field erection and shop fabrication.

Kellogg welcomes inquiries on its complete fabrication and erection service to the power piping industry from consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.

Fabricated Products Sales Division, THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.

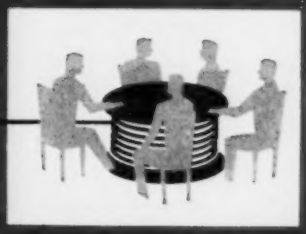
A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Co., Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., Buenos Aires • Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Companía Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

®Registered trademark of the M. W. Kellogg Company. Process Patented

WIRE AND CABLE ROUND TABLE



You have asked . . .

Q: Someone recently told me that polyethylene has been used for over twenty years in cable construction. Could this be true?

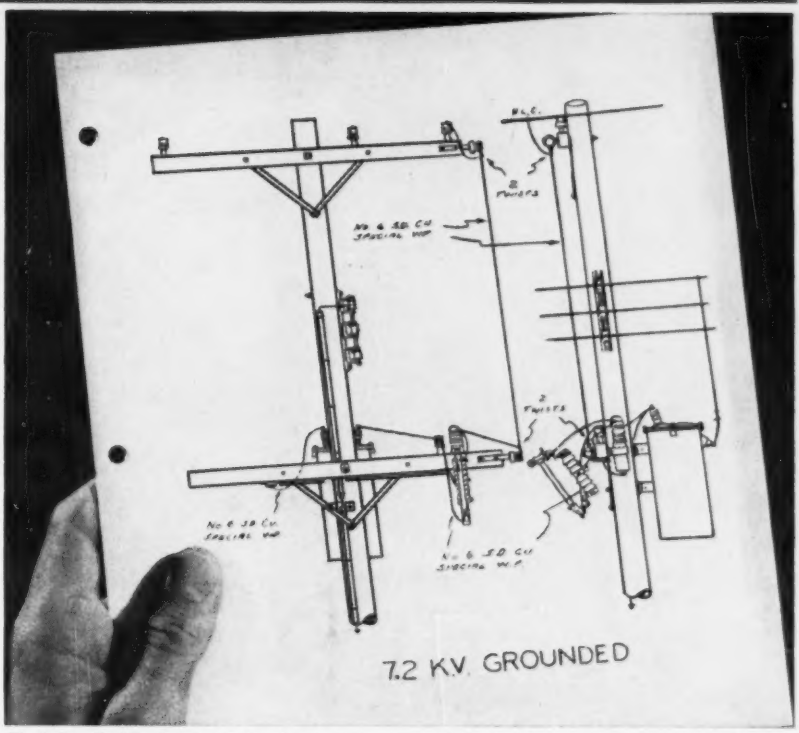
A: Yes, it is. Du Pont was the first company to distribute polyethylene in the United States, in the spring of 1939. This was done to test its acceptability and marketing possibilities. Polyethylene was first used as electrical insulation in 1939, when a coaxial cable was installed between Baltimore and Washington. Polyethylene's record during the war is well known.

Q: When referring to polyethylene what is meant by high density, high pressure, Ziegler, etc.?

A: Very simply, high-density polyethylenes have long chains of molecules with few branches. Those available commercially are manufactured by low-pressure processes, some of which use a so-called Ziegler catalyst (named after Dr. Karl Ziegler, of Germany, who was one of the pioneers in the use of particular catalysts at low pressures). Low-density polyethylenes have molecules with many long and short branches. They are usually manufactured by a high-pressure process.

However, the terms "high-pressure" and "low-pressure" have little meaning to a user of wire and cable, since they refer to the process by which the polyethylene was manufactured rather than the physical properties which result. Your purposes might be better served by referring to polyethylene by its various properties, such as corona resistance, stress crack resistance, etc. Your wire and cable supplier can best determine which type of polyethylene will meet your requirements.

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins for insulation and jacketing.



Typical method for framing single-phase-transformer installations with riser wire jacketed with Du Pont ALATHON 4-BK30 polyethylene resin.

ALATHON® meets six rigid requirements of Georgia Power for transformer riser wire

When Georgia Power Co., of Atlanta, Ga., was looking for an improved jacket for their transformer riser wire, they demanded six important qualities:

- Good dielectric properties
- Good weathering qualities
- Excellent abrasion resistance
- High strength and toughness
- Resistance to cold flow
- Resistance to stress cracking

The Southwire Co., of Carrollton, Ga., came up with the answer, a jacket of Du Pont ALATHON 4-BK30 polyethylene resin. This high-molecular-weight weatherproof compound meets all the requirements for use on primary distribution circuits ranging from 4KV to 13.2KV.

The jacket of ALATHON also provides an extra margin of safety against accidents such as the riser contacting the secondary service wires. And despite the thickness of the jacket (110 mils), the covered wire is still flexible and easy to handle.

For information on how ALATHON can solve your insulating and jacketing problems, write to your wire and cable manufacturer or E. I. du Pont de Nemours & Co. (Inc.), Department **M-1228**, Room N-2507A, Nemours Building, Wilmington 98, Del.

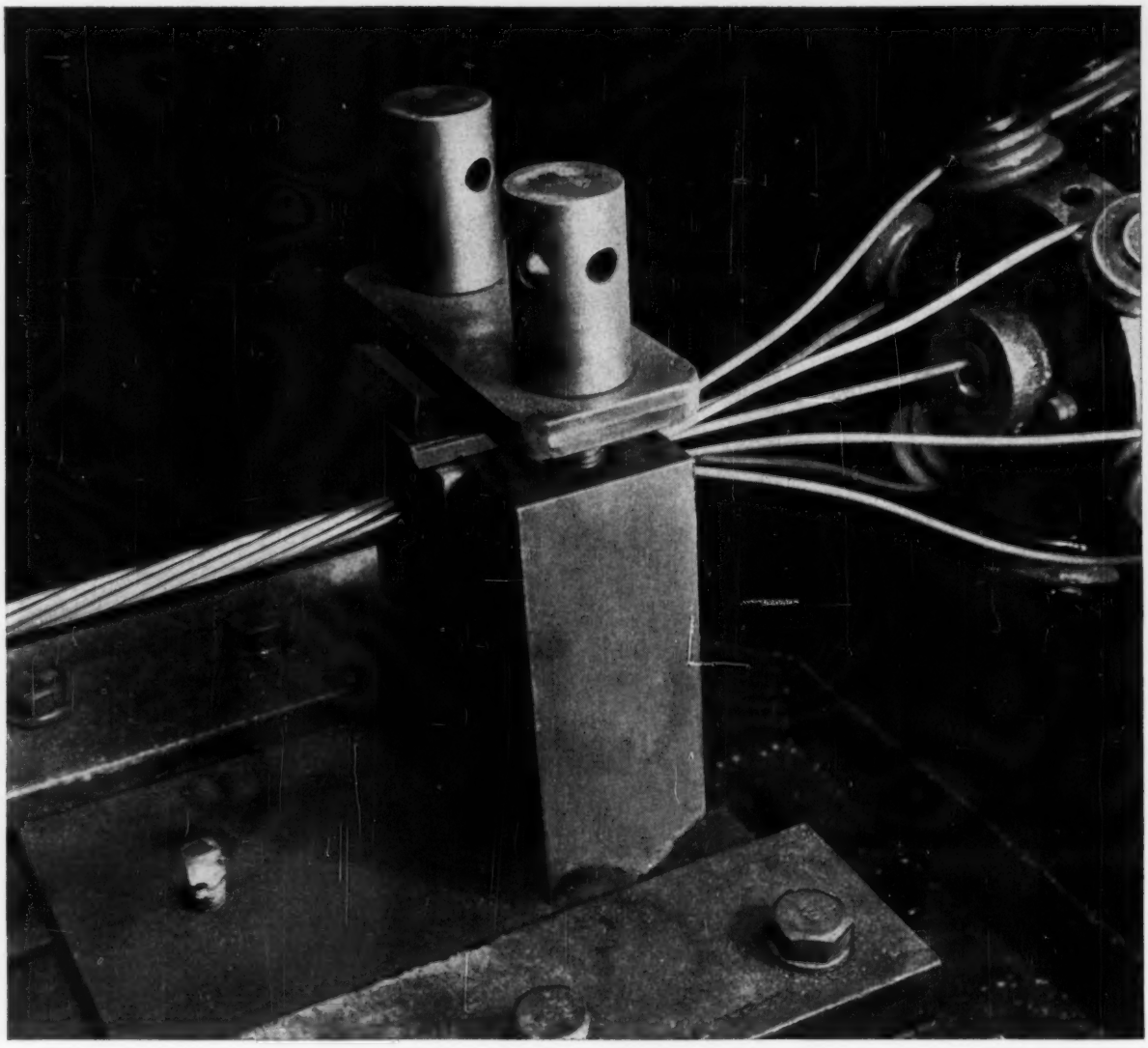
POLYCHEMICALS DEPARTMENT

DU PONT

REG. U.S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS



Smooth, uniform coating assures smooth stranding ...when you use BETHANIZED ACSR Core Wire

Bethlehem's Bethanized ACSR core wire has a smooth, uniform coating which makes it ideal for high-tension wire. Bethanizing is our unique electrolytic process which tightly bonds pure zinc to the steel wire. It withstands the stranding and forming without injurious flaking or peeling of the zinc armor.

Manufactured to meet the latest ASTM specifications, Bethlehem ACSR core wire is available in three weights of bethanized coatings: standard (A), heavy (B), and extra-heavy (C). Usually furnished in sizes from 0.1878-in. to 0.0661-in., it is shipped in coils of one continuous length. Coil weights are in accordance with ASTM specifications.

Just phone your nearest Bethlehem sales office for full information on any of your wire needs.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Distributor:* Bethlehem Steel Export Corporation

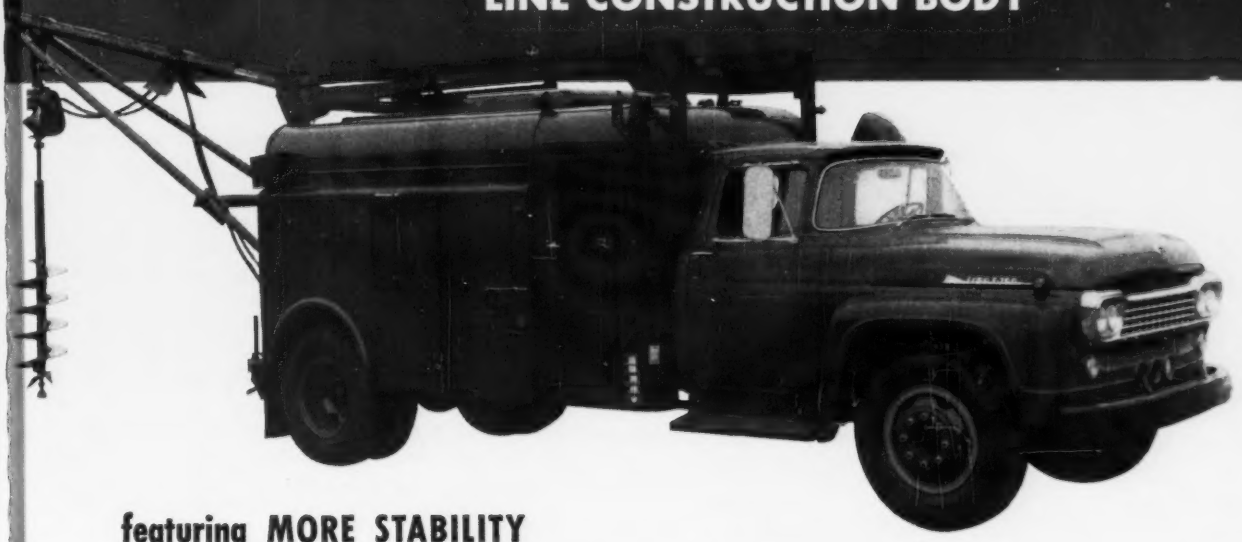
BETHLEHEM STEEL

BETHLEHEM STEEL

Announcing... NEW

YORK-HOOVER "Bobcat"

LINE CONSTRUCTION BODY



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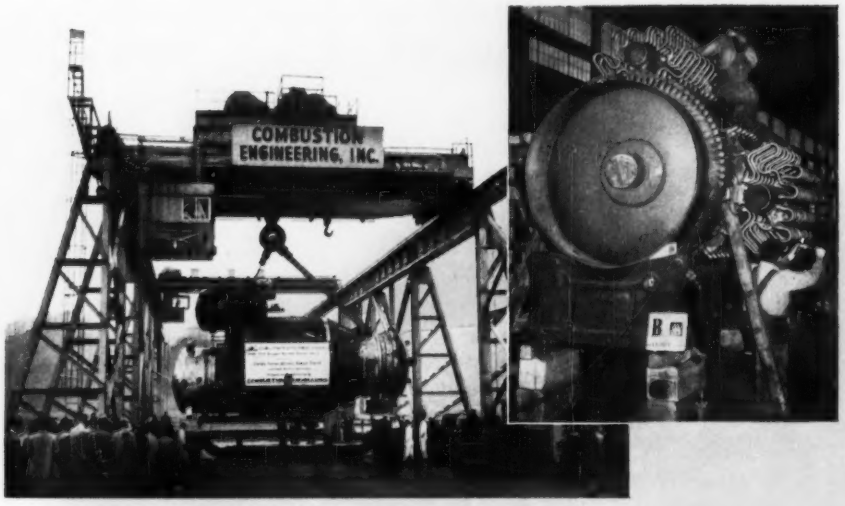
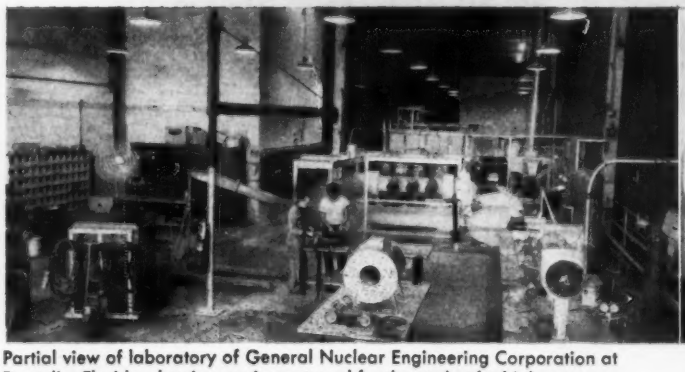


(Left) The huge riverside crane at Combustion's Chattanooga Division easily lifts this 92-ton stainless steel reactor vessel — the most complex reactor vessel built to date — into a barge for shipment to the Enrico Fermi Power Station, Lagoona Beach, Michigan.
(Right) Stainless steel sodium heat exchanger consisting of a series of tubes within tubes, encased in a pressure vessel.

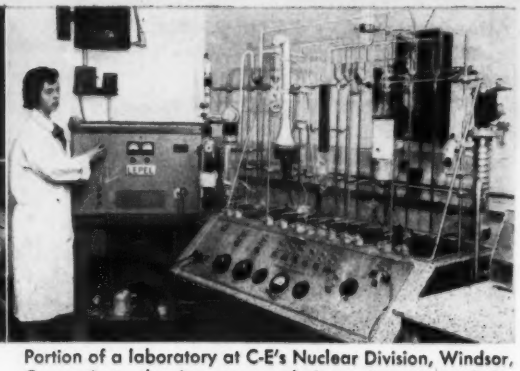
What C-E is doing to advance

The strange and wondrous world of the atom has been examined and surveyed by C-E scientists and engineers since 1946. The object—to put the controlled energy of the atom to productive use for the generation of power. The result—a wealth of knowledge and experience in the application, design and manufacture of nuclear power equipment. Backed by specially designed laboratories and manufacturing facilities, this knowledge and experience—greatly augmented and enriched by the acquisition of the General Nuclear Engineering Corporation early this year—has enabled C-E to undertake many kinds of nuclear work.

Notable C-E and General Nuclear projects are outlined on the opposite page. Virtually all of them are *current*, and many have a significant relationship to the vital task of making nuclear power competitive with conventional power. Collectively, these projects will contribute importantly to the Company's objective of achieving the same position of leadership in the atomic world of tomorrow which it has long since achieved in present-day methods of power generation.



Partial view of laboratory of General Nuclear Engineering Corporation at Dunedin, Florida, showing equipment used for the study of a high-pressure, high-temperature gas coolant system.



Portion of a laboratory at C-E's Nuclear Division, Windsor, Connecticut, showing gas analysis equipment used for detecting the presence of small quantities of gases in reactor materials.

The 520-foot-long Heavy Vessel Bay at C-E's Chattanooga Division was created especially for the manufacture of heavy nuclear components.

Portion of the 530-acre site occupied by C-E's Nuclear Division at Windsor, Connecticut. This Division is equipped for the development, design and test of reactor systems and the manufacture of reactor cores and core components.

Nuclear Power Progress

C-E NUCLEAR PROJECTS

For Electric Power Stations

- In association with Stone & Webster Engineering Corporation, a design study for AEC of an advanced type of large (236,000 kw) pressurized water reactor power plant.
- A long-term development program for AEC to determine the best means of using nuclear energy to generate superheated steam. (Success in this endeavor will be a big step forward in reducing the cost of nuclear-generated power.)
- Design studies for the Puerto Rico Water Resources Authority, under AEC contract, to determine the best means of adding nuclear superheat to a boiling water reactor.
- Design, research and development work covering a gas-cooled, heavy-water-moderated, pressure-tube type reactor for the East Central Nuclear Group, Inc., and the Florida West Coast Nuclear Group. This development will also lead to a nuclear power plant using superheated steam.
- The development and test of various kinds of fuel elements and fabricating procedures, under contract with the AEC.
- The design and manufacture of reactor vessels, including the largest and most complex vessels of their type built to date, for the Shippingport Station (America's first full-scale atomic power plant), the Enrico Fermi Atomic Power Plant, the Humboldt Bay Nuclear Power Station, and Italy's first nuclear power plant.

For Military Power Plants

- Design study for U. S. Army, under AEC contract, of a truly package type of nuclear reactor, using the boiling water concept, for remote installations. This program includes operation of a prototype boiling water reactor at the National Reactor Testing Station in Arco, Idaho, and the training of military technicians in the operation of the installation.
- The conceptual design and operation of a nuclear test reactor, under AEC contract, to permit full-scale testing of prototype reactor cores for military field plants.

For Naval Power Plants

- The design and manufacture of a submarine reactor system designed to set new standards of accessibility, speed of startup and operational flexibility—and the operation of a land-based prototype installation.
- The design and manufacture of numerous reactor cores, reactor vessels, steam generators and pressurizers for various types of submarines and naval surface ships.

For Merchant Ship Propulsion

- The design and engineering study of a prototype pressurized water reactor for a 45,000-ton tanker, under contract with the AEC and the U. S. Maritime Commission.

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- Bio-assays, decontamination, environmental monitoring, radiochemical analyses and radiological safety programs.

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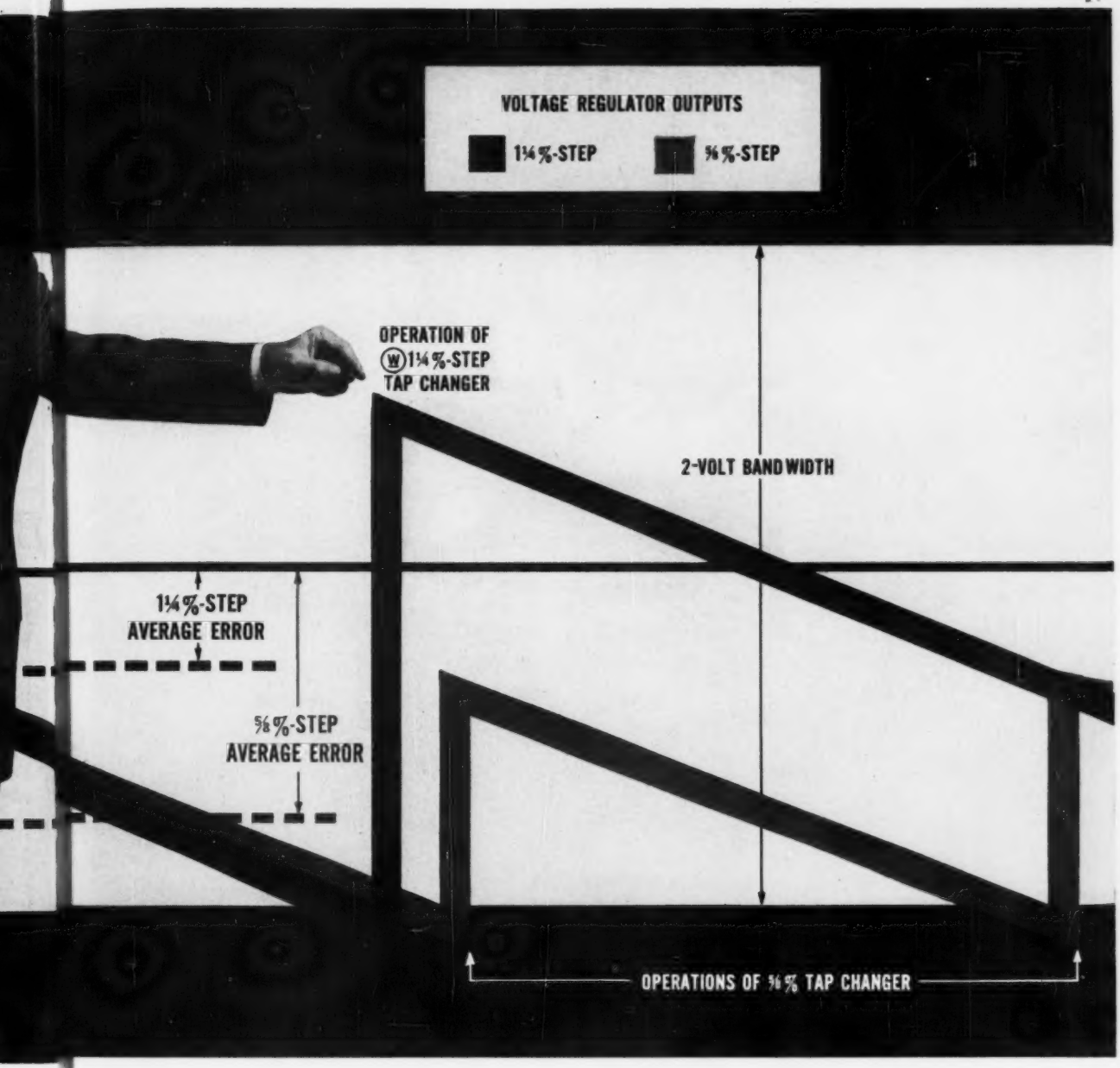
Here's how Westinghouse 1¼%-step regulation provides

Tap changer operations are the key to good system voltage control since no regulating is done until the tap changer operates. For best results, tap changes should be correctly timed and reasonable in number.

With ordinary control schemes, voltage relay bandwidths are often set in such a manner that it becomes necessary to effectively widen the band by adding fixed time delay to prevent an unreasonable number of tap changer operations. Where this is done, regulator output voltage bandwidth may vary widely, depending on the rate and extent of variation of input voltage. But with Westinghouse URL and URF regulators, you set the bandwidth you want and the unique CVR inverse time voltage relay, combined with instant response tap changer, prevents sustained wide voltage variations which are possible with fixed time delay. The result . . . a narrower effective band in the actual output where it counts. As an added benefit, the larger step gives an average voltage closer to midband, as shown in the illustration above.

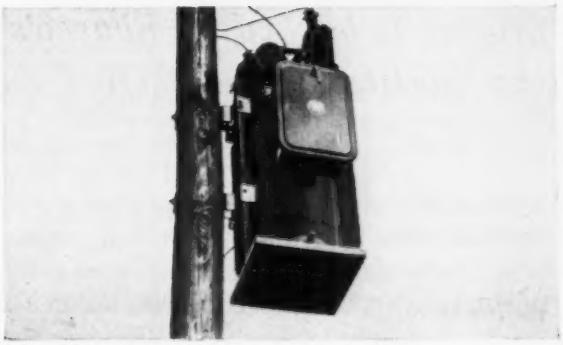
You can protect your customers against abrupt voltage changes, get narrower effective bandwidths, and achieve better average levels when you use



closer voltage control . . . with fewer operations

Westinghouse 1¼ %-step regulators; and you get longer life with reduced maintenance because fewer operations are required.

Ask your Westinghouse sales engineer for further details about the bonus values from Westinghouse 1¼ %-step voltage regulators. J-70902



YOU CAN BE **SURE**... IF IT'S

Westinghouse

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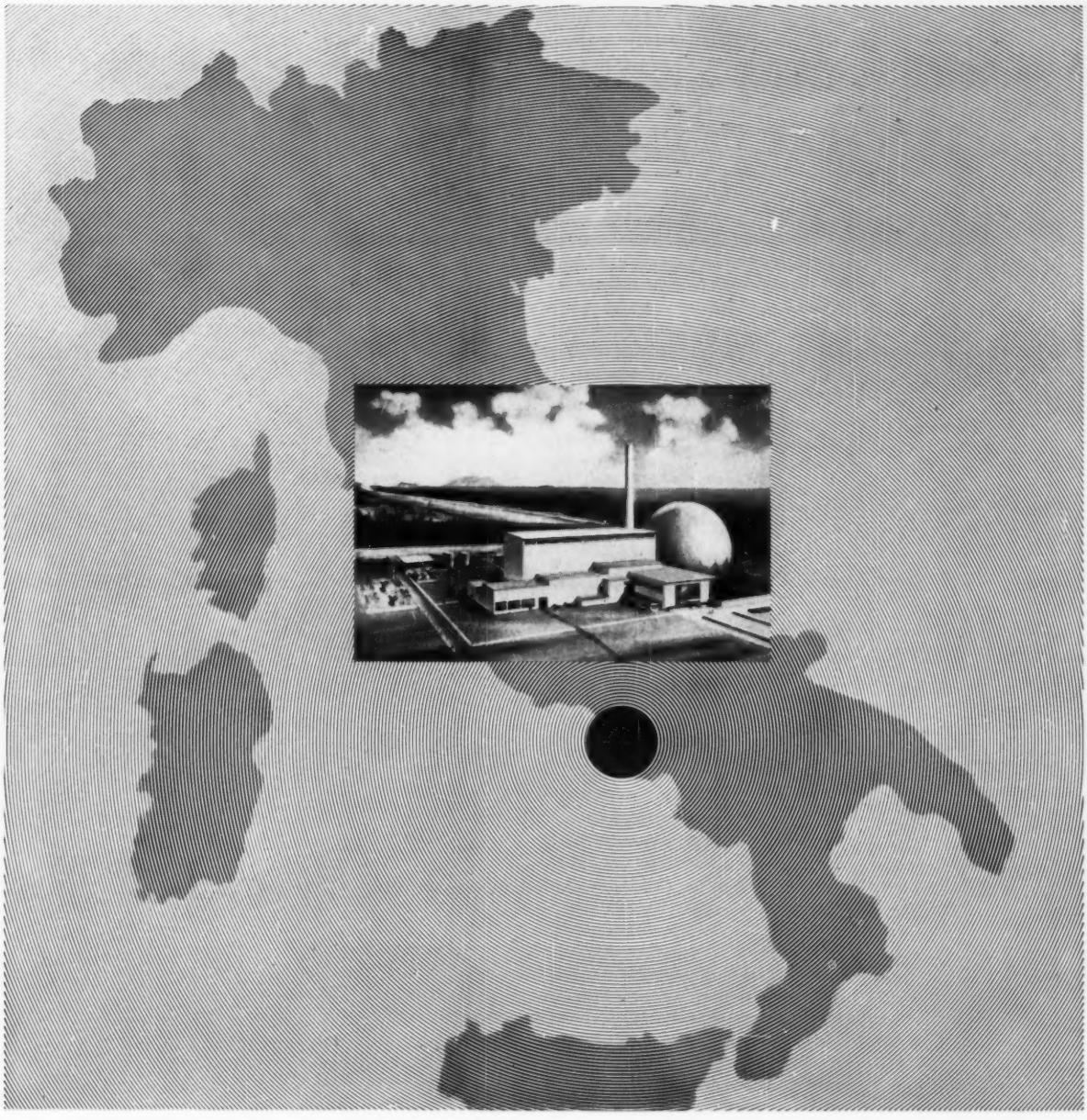

A new atomic power plant for Italy... the SENN plant near Naples. Engineering and construction is being handled by Ebasco. This project is backed by Ebasco's 54-year reputation for outstanding quality in diversified engineering and construction work.

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New ORANGEBURG® CA* CONDUIT *with Flush Coupling Attached!*

With no separate couplings to handle or attach on the job, Orangeburg CA lays faster, costs less to install. Each long, light length has a *flush* coupling attached at one end and a standard 2° male taper at the other end, making installation a simple, one-step operation. And, since the coupling *is* attached, there are no coupling cartons to warehouse or carry to the job.

What's more, with the coupling *flush* to the conduit's outside wall, new CA is easy to stack, store and handle. The flush coupling also eliminates "staggered" joints in the trench. And that means real savings in cutting and tooling time.

Like the hundreds of millions of feet of Orangeburg fibre conduit in use since 1893, new CA has self-sealing joints and impermeable walls. Its smooth, 100% fibre raceway adds years to cable life.

New Orangeburg CA is available in 2", 3", 3½", 4", 4½" and 5" sizes. Orangeburg Standard and Nocrete Conduit, with separate sleeve couplings, are available as always. Write Dept. EW-129 for Catalog 52.

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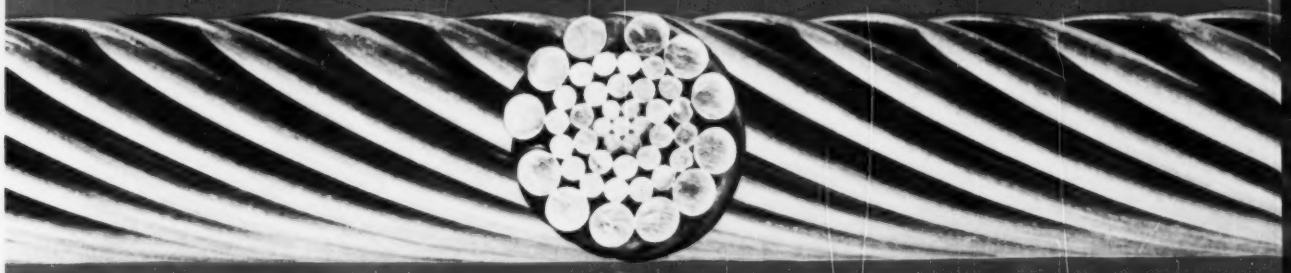

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CRESCENT AND CRESTOLOY

outsell all other ADJUSTABLE WRENCHES

CRESTOLOY Wrenches are forged from a special alloy steel permitting thinner, trimmer design with greater strength and less weight than conventional types. They are available in Single End patterns, 4″ to 24″ size. Double-end in four models combining 4-6; 6-8; 8-10; 10-12 inch sizes. The 15″, 18″ and 24″ sizes, available in Single End pattern only, are distinguished by their tapered handles. There is no stronger or finer Adjustable Wrench than CRESTOLOY.

CRESCENT Wrenches are forged from special steel, particularly adapted to wrench manufacture. They are carefully heat-treated to increase their toughness and durability. Due to their lesser cost and relatively great strength, they are widely used in industrial service. Available in seven Single End Patterns, 4″ to 18″.

Both CRESCENT and CRESTOLOY Wrenches represent the best in design and workmanship, and carry the same guarantee.

CRESCENT and CRESTOLOY TOOLS are sold by hardware dealers and industrial distributors everywhere. Look for the bright yellow Crescent Display panels and select from one of the world's greatest assortments of quality hand tools.

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

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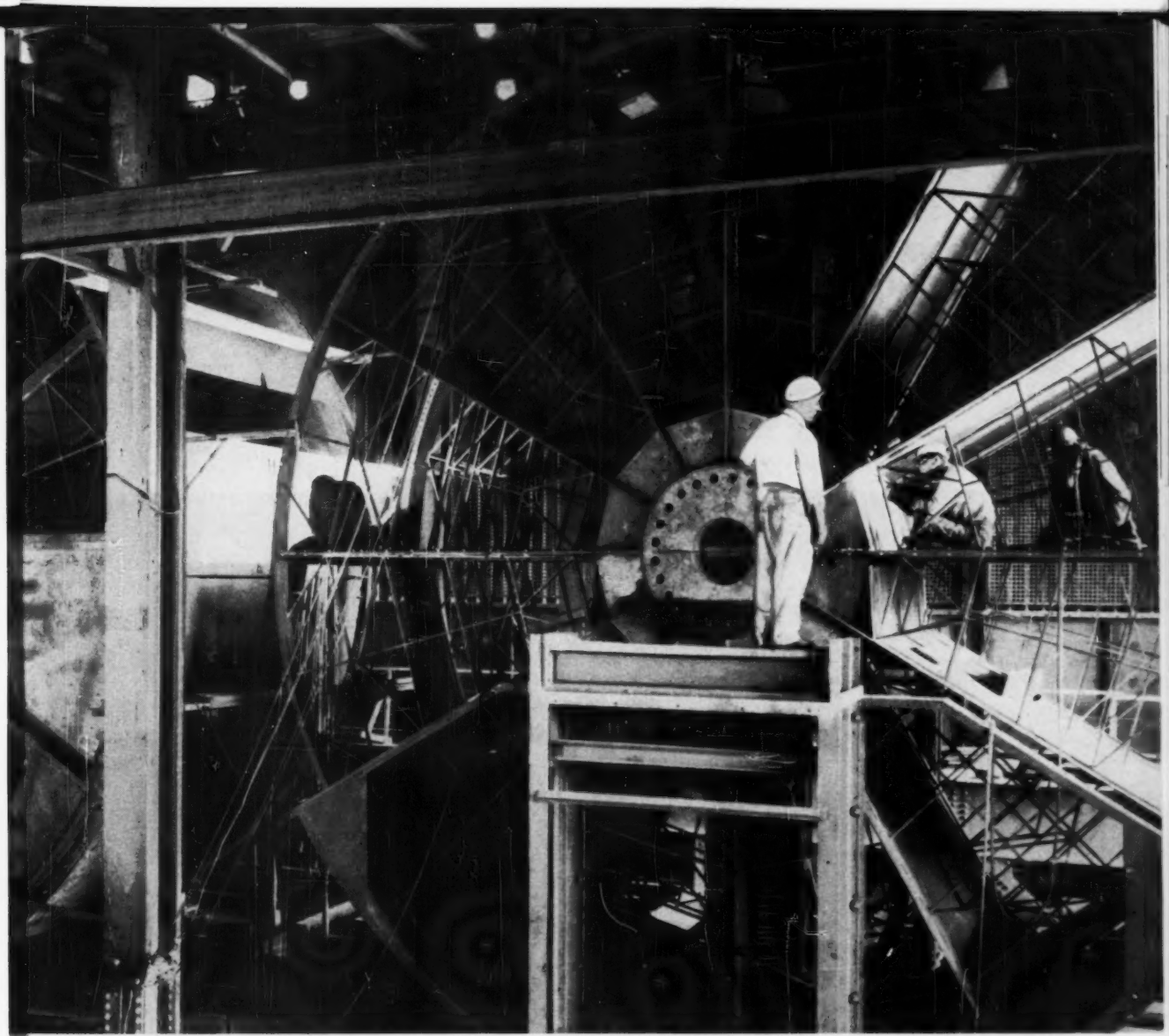


Two of the four Ljungstrom Air Preheaters under construction at Potomac Electric Power Co.'s Dickerson Power Plant, Dickerson, Md. Each pair of these Ljungstroms, with a combined heat exchange surface of 475,000 sq. ft., will serve one boiler, evaporating 1,300,000 lbs of steam/hr. The first 175,000 KW unit was placed in operation in June this year and a duplicate unit is now under construction.

AIR PREHEATER SERVICE

PROTECTS POTOMAC ELECTRIC POWER CO.'s NEW **LJUNGSTROMS®** TWO WAYS

From the moment they start—and as long as they operate—these Ljungstroms will get double-header Air Preheater service: protection against routine wear, and insurance of maximum operating efficiency. This is how.

Lifetime Air Preheater Service provides regular inspection and the services of expert technicians throughout the life of each unit. Air Preheater engineers make personal calls at least once a year on every Ljungstrom installation to make sure that all units are in top condition. This type of service is still in effect on Air Preheaters dating from 1923.

Rapid factory service gives the best possible protection against routine wear, the best insurance of readily-available replacement parts. In one typical case, an Air Preheater customer 500 miles from the factory received *custom-fabricated* parts within ten hours after his initial request for these parts.

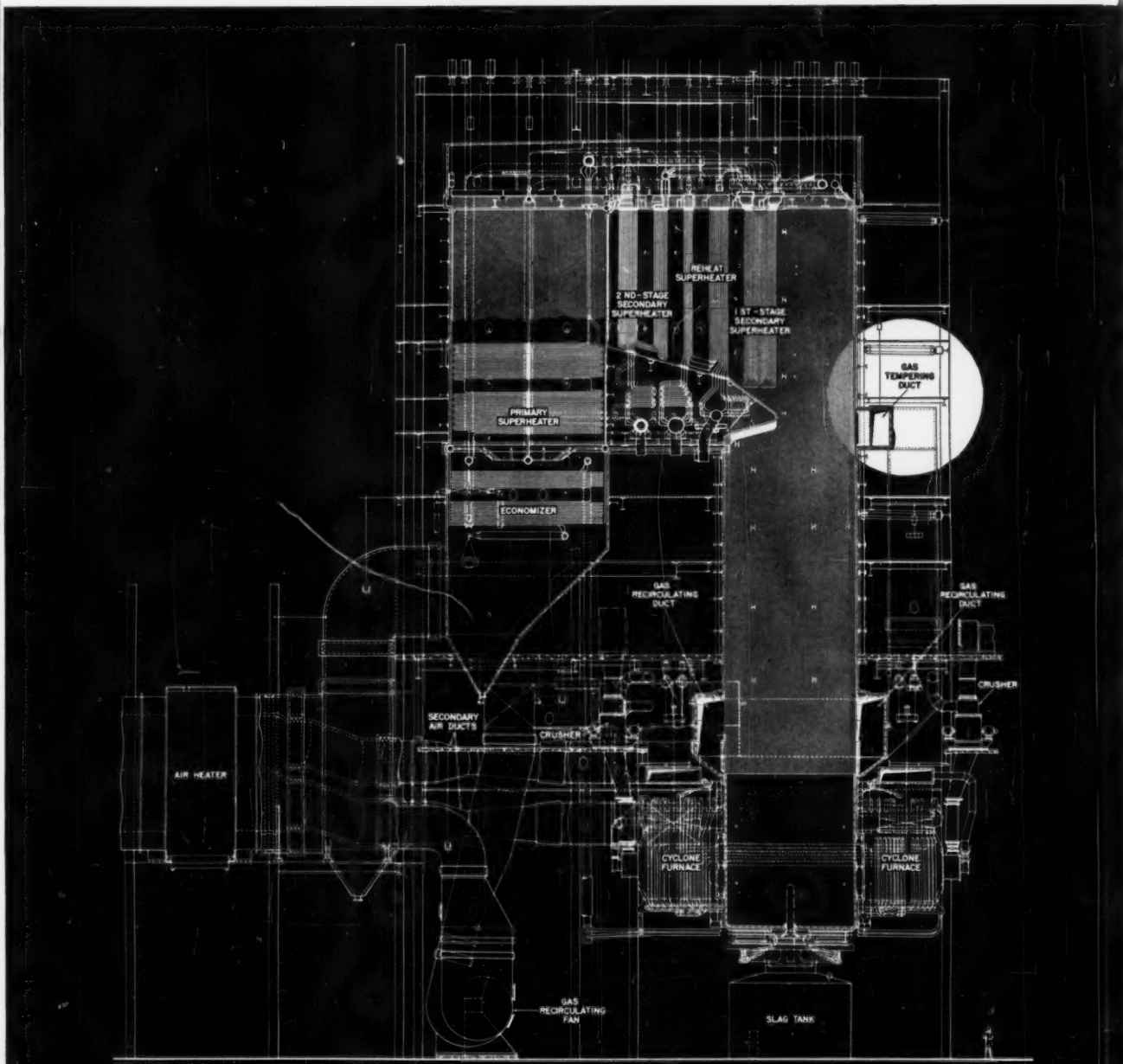
Regular inspection and fast response to emergencies are just two advantages Air Preheater offers its customers. Another is expert knowledge of boiler and preheater problems, gained through 35 years' experience. These reasons—knowledge of our customers' problems and a *continuing* interest in them—probably explain why nine out of ten preheaters sold today are Ljungstroms.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

Gas Tempering: **Report No. 2**

Electric Utilities Find Points Way to



B&W Cyclone Furnace Universal Pressure Boiler.
Coal is the primary fuel with oil as an auxiliary fuel.

Gas Tempering Fuel Economies

...Lets You Burn The Most Economical Fuel Available— Coal, Oil or Gas

Gas Tempering—is the reintroduction of cool flue gases near the furnace outlet to control the temperature of the gases entering the convection surface. It is the practical means to help you burn the most economical, most easily available fuel.

Gas Tempering enables you to burn a variety of coals without slagging.

It minimizes external corrosion of superheater tubes. It reduces metal temperature, cuts need for high alloys, prolongs tube life, regardless of the fuel burned.

In effect, gas tempering allows you to adjust the size of your furnace to meet the characteristics of the fuel. This is done by varying the amount of tempering to chill the furnace exit gases to a temperature known to be satisfactory for the fuel burned. The gases are cooled but the total heat available to the superheater remains the same.

That's Why with Gas Tempering, you no longer need to pass up attractively-priced fuels.

Definitive Booklet: If you'd like to learn more about the economies and design flexibility available to you through Gas Tempering, write for Bulletin G-96. Address: The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

Major Advantages of B&W Gas Tempering

. . . It cuts overall plant costs because the smaller size unit requires a smaller building per kw, a lighter foundation, less structural steel and shorter steam leads.

. . . It enables you to utilize the most economical available fuels. It permits the burning of a variety of coals without slagging, minimizes external corrosion of superheater tubes, and assures safe metal temperature, thus prolonging tube life, regardless of the fuel fired.

. . . It provides safe superheater tube temperature by positive gas temperature control; it protects superheater during startup and under all operating conditions.

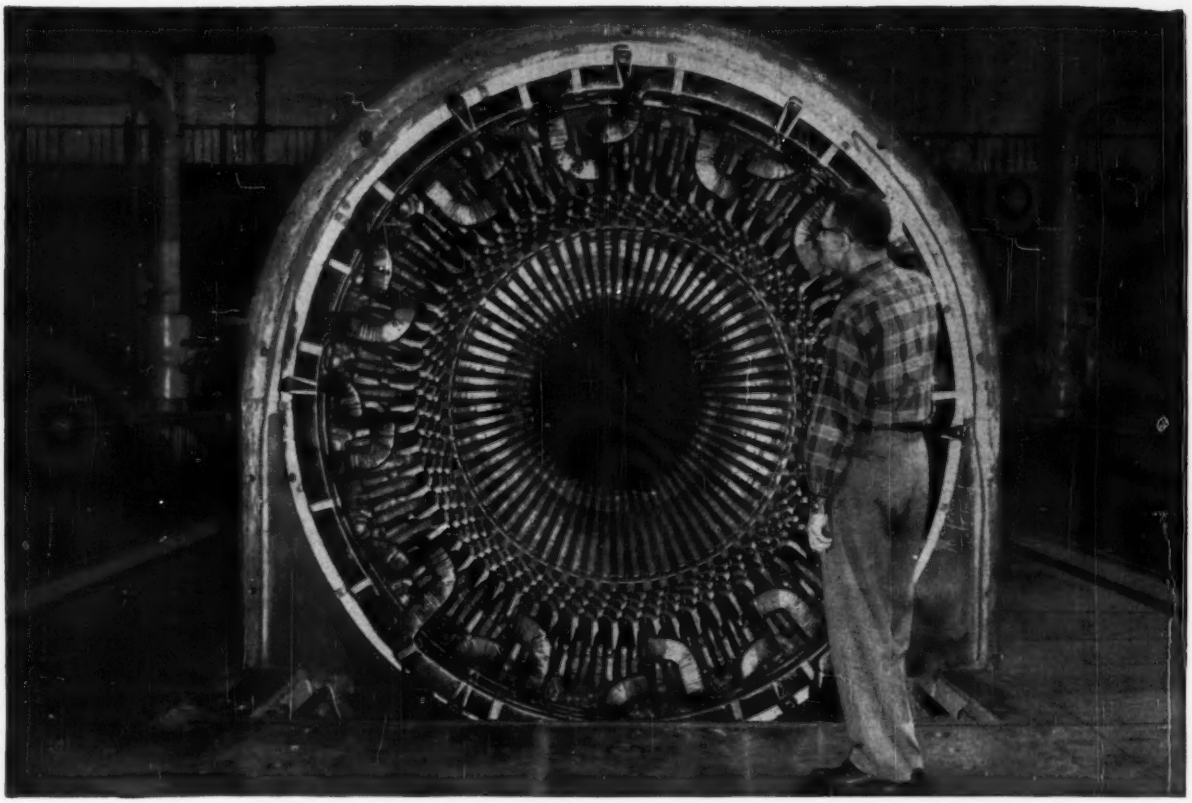
. . . It makes it safer to design for economies offered by operation at steam temperatures of 1050 F and above.

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

G-934



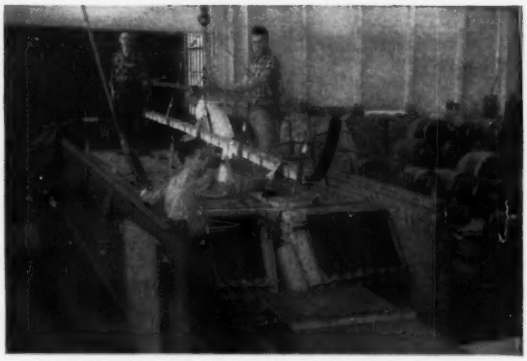
22,000-volt generator rewound with NECCOBOND coils by National

...The Specialists in electric coils/repair service

After years of service, tape separation on the stator coils of this 75,000-KW, 22,000-volt turbo generator made reliability uncertain. Thus Commonwealth Edison Company decided to replace the winding.

The winding was redesigned to employ the NECCOBOND insulation system, which bonds all the coil insulation elements into a solid unit. The insulation now has the high mechanical strength to withstand cycling operation without tape separation.

When you replace high voltage coils, investigate the advantages of NECCOBOND. It is based on time-proven insulating materials—mica and glass. These are welded by a special impregnant into a tenaciously bonded, resilient, voidless insulation wall. A unique method of fabrication assures homogeneous insulation. *For more information call National's Columbus plant... HUdson 8-1151. Or call the nearest National Field Engineer.*



New 27-foot coils being loaded for direct shipment to generator site where rewinding time was substantially reduced.

National Electric Coil

DIVISION OF McGRAW-EDISON COMPANY • COLUMBUS 16, OHIO

Electrical Engineers • Manufacturers of Electrical Coils, Insulation, Lifting Magnets
Redesigning and Repairing of Rotating Electrical Machines

McGRAW EDISON

Survey of the '60's:
A Journey of Rediscovery

This year signals the end of the decade. We are closing the books of the electrical utility industry on a turbulent ten years, and starting afresh into a new period. Judging from the quickening tempo of business and technology, the new decade bids to overshadow the last completely. Thus it is that EW's editors in this issue have launched into a Survey of the Sixties, to try to outline their ideas of what will come for the utility business (see p 69).

After marshalling our thoughts and ideas and getting them on paper, we've come up with a firm impression we strongly hope will be shared by others: the electrical utility industry has been tremendously undersold to our young people selecting their lives' work.

Even accepting our enthusiasm as the product of pride and hope, we cannot help but feel that the future, as we see it, spells excitement in every segment of utility activity. There's no room for incompetence or faint hearts here. There's *plenty* of room for spirited, inquisitive, hot young blood.

Nevertheless, the fact remains it's been difficult, generally speaking, to attract highly competent young graduates into the electrical utilities in competition with the horn-blowing, PR-conscious, well-heeled firms in the so-called "glamor" fields.

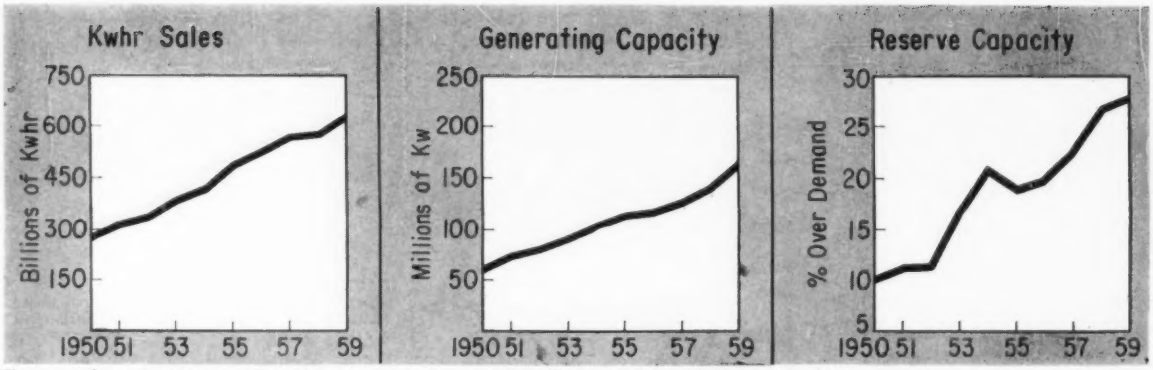
Unfortunately, this has held true not only in its most painful—and most publicized—area, engineering. It has been acute across the spectrum of utility personnel needs.

While the first and most obvious problem is in the ranks of younger employees, the dilemma has a more serious, long-range effect. With insufficient "make-up" of young, aggressive, competent people entering the industry, there must inevitably be an insufficient number of properly-equipped aspirants striving for the top management slots as they open.

What we urge is this: let each utility reader who glances through EW's Survey of the Sixties do so with the thought of rediscovering for himself what an exciting business he is in. If our editors have done their job properly, each reader should be convinced. If he's already sure of it, we hope our efforts will help him nail down the idea.

If we've really made any converts, perhaps there will be a new band of missionaries preaching the gospel of a vibrant, challenging enterprise to parents, educators, and young people.

What the utility industry badly needs is a few more of its own people blowing the industry's horn.



Charts are for entire industry unless otherwise noted. Source: Edison Electric Institute and Electrical World

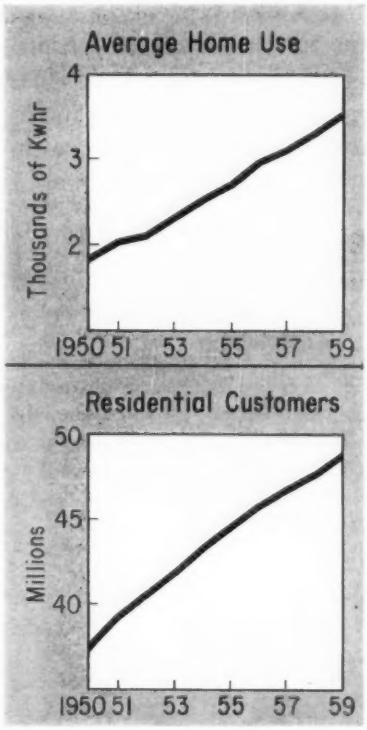
The Fifties: Growth and Technical

Companies' revenue, net income increase 100% for decade, taxes rise 122%. Average coal rate per kwhr drops 27%

In a period when the U. S. economy was disrupted by the Korean "police action", two business slumps and inflation, the country's electric utility industry's solid accomplishment during the Fifties becomes all the more noteworthy.

The entire industry spent a total of about $40 billion on new plant and equipment this past decade. Of the $40 billion, around $30 billion was spent by investor-owned power companies. The outlay is equivalent to the combined electric utility plant account by investor-owned utilities from the industry's start in 1879 through 1955.

Construction expenditures by investor-owned companies were at a rate of $2.15 billion in 1950 compared with a $3.5-billion rate at the close of the decade.



Capacity Up 94-Million Kw

New generating capacity (gross) added during the last ten years by the entire industry totaled nearly 94-million kw. The investor-owned companies share of installed capacity dropped from 80.1% at beginning of 1950 to the present 75.6%. In this same period, government-owned capacity rose from 19.4% to 23.7% and rural electric co-ops gained from 0.5% to 0.7%.

The main indication of the efficiency of new, larger generating units completed in the Fifties is the 27% decrease in the amount of coal required to produce one kwhr. The average ten years ago was 1.24 lb per kwhr; today it stands at an estimated 0.90 lb.

Total electric revenues of investor-owned utilities hit $9.150 billion this year, which is more than a 100% increase over the $4.5 billion earned during 1950.

During the Fifties these companies jumped their net income from $831 million at the end of 1950 to $1,670 million by the end of 1959. This is a 100% increase for the decade.

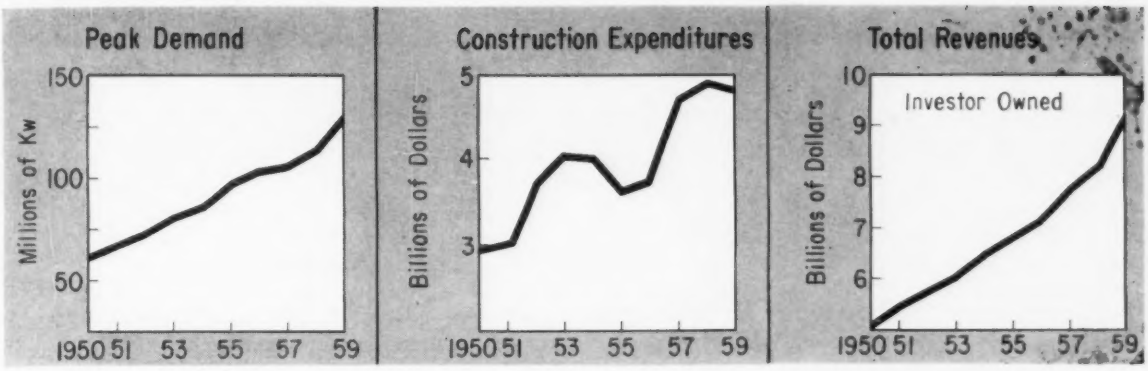
The major expense for power companies during the decade was taxes. Federal, state and local taxes required an outlay of $948 million during 1950. This year $2.1 billion was paid, an increase of 122% over 1950.

A study by F. S. Smithers & Co indicates the performance of electric utility stocks during the past decade. Based on Moody's Average of 24 Electric Utility Stocks, the per-share earnings rose from $2.62 in 1950 to an estimated $3.85 this year for an increase of 47%. Dividends for the same period rose 50% from $1.76 to about $2.64.

The market price of the stocks averaged $31.23 ten years ago compared with this month's $65.46. This represents a 110% growth. For the same period the group's price/earnings ratio rose from 11.9 to 17.

In 1950 the return on investment in these stocks stood at 5.66% while ten years later it had decreased to 4.03%.

The Smithers report compares this record with averages of industrial stocks and makes the point: "The assumption that utilities are primarily income stocks is far from realistic and not in conformity with the record of constantly increasing earnings and dividends".



Gains Help Offset Inflation, Slumps

One factor in the industry's resistance to recessions is its ability to hold down operating expenses. The operating ratio (amount of revenue left after fuel, maintenance, wages and salaries, and other operating expenses) has tapered off from 49.4% in 1949 to 43.7% this year, a decrease of 5.7%.

Fuel expenditures in 1959 hit a record $1.4 billion, for nearly a 100% increase over 1950. Salaries and wages went from $934 million to $1,420 million in ten years.

Reserve capacity, as a percentage over demand, continues high. However, as more regions shift to summer peaks, reserve figures based on winter peaks tend to lose some of their significance. With some northern and many southern utilities having summer peaks much higher than winter peaks, it would be misleading to conclude that reserves are continually rising. The industry had about 35 million kw of reserve capability at the end of this year compared with 8-million kw at the close of 1949.

The industry's peak demand in 1949 was 56.5-million kw. Ten years later this had risen 128% to 129.3-million kw.

The Fifties found the federal encroachment issue as a dominant theme in the field of legislation. The most controversial issues involved the Dixon-Yates contract, Hells Canyon, Niagara and the Tennessee Valley Authority's self-financing measure. Recent developments are discussed on page 61.

Major milestones included Lights Diamond Jubilee in 1956, the placing in service of the investor-owned utilities' 100 millionth kw of generating capacity in 1958, the National Electric Living Program's debut in 1959, and the coming of age of electric heating.

Engineering Gains Made

Important engineering and technological progress marked the Fifties.

One of the best publicized advances came in nuclear power. In slightly over five years since passage of the Atomic Energy Act, the electric utility companies spent about $241.7 million for atomic research, development and construction. This does not include operating cost. By the end of 1959 a total of about 90,000 kw of nuclear capacity was on the line and about 1.5 million kw more was being designed, under construction or in various planning stages in the U.S. by the entire industry.

Shippingport Nuclear Power Station, the world's first full-scale commercial A-plant, achieved criticality on Dec. 2, 1957 and began feeding power into Duquesne Light Co's system on Dec. 23, 1957.

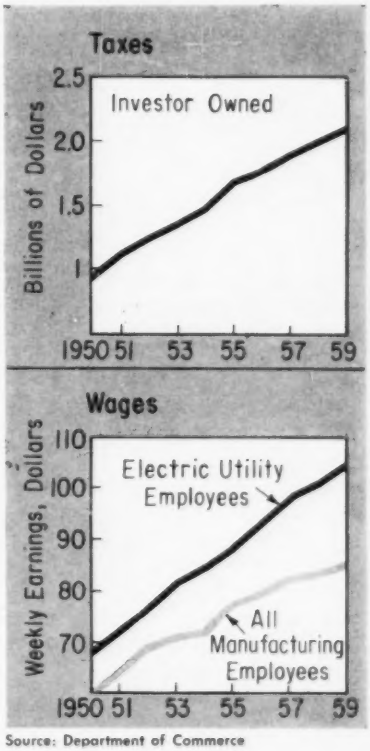
In steam generation, the development of re-heat in the 1,000-1,050-F range marked a bold attack on rising fuel costs. Introduction of the super-critical cycle at American Electric Power Co's Philo plant was another big step that is influencing large plant design, engineering and economics.

Research gains in the more exotic power sources, such as the fuel cell, thermionics, thermonucleonics and magnetohydrodynamics, indicates that conventional means of generation will undergo radical changes in the next ten to 20 years.

Old-time sources of solar, geothermal and wind energy also may play a small role in remote areas.

The re-awakened interest in pumped storage was a highlight of hydro power development. Com-

(*Continued on page* 140)



Source: Department of Commerce

King Re-emphasizes Lead Over USSR

EEI president notes gains in U. S. generating capability and output, says Russia can't catch up in 'foreseeable future'

U. S. citizens who keep abreast of current events may soon conclude that they are witnessing two power races: the first finds the nation's electric utility industry pitted against the power producers of the Soviet Union; the second is the contest between investor-owned utilities and public power advocates to convince the American public, respectively, that we're going to remain far ahead of the Russians or that we're going to be overtaken.

The investor-owned point of view is re-emphasized in Allen S. King's report on the industry's performance this year. In it, King states, "There is no indication that the Russians will be able to catch up with the United States at any time in the foreseeable future."

Capacity Gap to Widen

The president of both the Edison Electric Institute and Northern States Power Co, King bases his prediction on an estimated 245-million kw generating capability in the U. S. by 1965 compared with Russian goals of 110 to 112-million kw at that time.

As of now, he adds, the nation's total generating capability, including railway and industrial plants, is 183-million kw. The Soviets have about 59-million kw.

Another facet is the per capita use of kwhr. In the U. S. this year, it was 4,481 vs 1,161 in the U.S.S.R. "The Russian goal for 1965 is about 2,100 kwhr. This compares with a forecast of about 6,000 kwhr per capita for that year in the U. S.," he said.

King takes to task "certain government power advocates, recently returned from Russia," whose descriptions of some large Soviet hydro projects leaves the impression we're behind in hydro development.

"Actually," says King, "the U. S. now has about three times the hydro capacity of Russia. In 1959, hydro production in the U. S. totaled 152-billion kwhr—three times an estimated 50.7-billion kwhr for Russia."

Both countries have about 20% of their facilities in hydro and Russia's new capacity expected by 1965 will find hydro dropping to 15%. These are points the government power advocates have neglected to make since their return, King charged.

As for atomic power progress, the U. S. has three plants in operation and three more coming on the line in 1960. These will produce about 490,000 kw, said King. The Soviets have five plants with an aggregate of 465,000 kw now completed or under construction. And "the size of the atomic development program in the U. S. is considerably larger than in Russia," King declared.

KING: A 3-to-1 hydro advantage

Since 1954, a total of 131 power companies and associated service groups were participating in A-plant development and construction, and in projects requiring major research, development and study. They are taking part in 16 plants with a total 1.4-million kw capacity costing more than $570-million.

This year the U. S. generated 707-billion kwhr, an increase of 9.6% over 1958. In addition, the country's railway and industrial plants produced 83-billion kwhr, said King. The Russians, meanwhile, produced 244-billion kwhr this year.

The record-breaking increase in capability of 15.3-million kw by U. S. electric utilities in 1959 was a 10.3% gain over a year ago. Investor-owned companies added 11.8-million kw of the total.

A 1959 peak of 129.3-million kw was backed up by a 35.5-million kw reserve, for a 27.5% margin, King said. Construction expenditures by electric companies hit $3.5 billion this year and $3.4 billion is expected to be spent in 1960.

A new high of 625-billion kwhr were sold in 1959 with industrial customers buying 48.4% of the total, residential 27.6%, and commercial 17.9%. About 1.3-million customers were added during '59.

Average annual use per residential customer was 3,550 kwhr, or 184 kwhr above 1958, while average revenue was 2.51¢ compared with 2.53¢ last year. Gross revenues for the companies were $9,150 million, a gain of 8.2% over last year, while net income was $1,670 million, up 9%. Anticipated 1959 tax payments are $2,120 million, an increase of $157 million over 1958.

Test of Concrete Tower Set for EHV Project

The use of concrete in the construction of large transmission towers will be assessed in General Electric Co's "Project EHV." A 115-ft high by 92-ft wide prestressed concrete tower will be installed in the southern portion of the 4.5-mile test line which GE and nine cooperating companies are building near Pittsfield, Mass.

Prestressed Concrete Institute is supplying the tower. It will carry conductors energized at 460 to 750 kv. Norman Scott, the institute's director, said low initial cost and freedom from maintenance were advantages typically offered by use of concrete.

When completed late next year, the tower probably will be the largest of its type in the world.

PRESIDENT'S hold-the-line spending policy may undergo change since Congress found his veto surmountable

Industry to Feel Effect of Studies

Water and hydro resources, Soviet progress, BPA line and REA loans are among topics Congress will review in '60

No activity of the federal government during 1960 will have more far-reaching effect on electric utilities than the results of several studies to be submitted to Congress before it adjourns next summer.

These studies include:

1. A long-range review of the nation's water and hydro power needs and resources through 1980.

2. A report on Soviet progress in power development.

3. A study into the need for either a private or federal interconnection between Bonneville Power Administration and California.

4. Several other less publicized studies.

I. Kerr Study Due

Most important of these studies is one being drawn up by the Senate Special Water Resources Committee headed by Sen Robert S. Kerr (D-Okla.). This report (S. Res. 48) will be submitted to the Senate just before it adjourns this coming summer—and its recommendations for future hydro power needs will have a strong impact on Congress and federal policy in the coming years.

The report will favor large, federal-type dams and river basin planning. It is also expected to recommend enactment of legislation to create a White House "Natural Resource Council" and a "Joint Congressional Committee on Natural Resources," plus other legislation to revise federal allocation methods at multi-purpose projects.

Two hearings of interest to power companies will be held by the committee in the spring: (1) a special hearing on anticipated differences of opinion in a joint report, "Future Needs of Water for Generation of Power," being prepared by American Public Power Assn, Rural Electrification Administration, Federal Power Commission and Edison Electric Institute; (2) a major wrap-up hearing by the entire committee when all special reports and testimony has been completed.

II. Soviet Impact

Strong propaganda value for public power advocates will be made by submission in early January of the findings of an 11-man delegation which toured U.S.S.R. power installations this past fall. Lengthy comments from each of these members—all public power supporters—are expected to emphasize the swift expansion of Soviet power development, and they will be used as a basis for promoting more federal generation and transmission.

Another emphasis of the Soviet report will come in a possible new drive to approve a resolution creating a special study of the nation's transmission line needs. This resolution (S. Res. 71) was introduced last year by Sen James Murray (D-Mont.), but was shunted aside for the water resources study (S. Res. 48) now being completed.

Chances for enactment of the transmission line study were considered to be dim, but emergence of the Soviet report may give S. Res. 71 another chance of passage.

III. Pacific Inter-Tie Up

The long-proposed Bonneville-California intertie will make headlines again in February. BPA has asked a second delay—to Feb. 15—in completing a study of the needs for a federal or private high-voltage line between its system and either Pacific Gas & Electric Co or federal Central Valley systems.

This report—due last July, and later set for Dec. 31—was requested by public power advocates to head off a proposed line by PG&E. The report probably won't make any concrete recommendations for the line, but more likely will point out the advantages of each. An interim report, now circulating in the Interior Department, is understood to lean toward the PG&E line.

IV. REA Loan Report

Loans made to co-ops to serve customers in towns with more than 1,500 population is the subject of a

report, just completed by REA for the Senate Appropriations Committee. Whether the committee will hold hearings on it won't be decided for awhile. REA Administrator David Hamil, in the report, points out the view of the Agriculture Department that, once a co-op has received loan permission to serve such customers, the legality of the service continues, regardless of how large the town becomes.

In particular, Hamil was asked to comment on nearly 300 cases where co-ops were reported to be serving in towns over 1,500 population.

V. Atomic Energy

The Administration is expected to ask Congress for about $2.8-billion for the Atomic Energy Commisssion's fiscal 1961 budget—about the same as for the present year. Overriding consideration in this is the President's request to hold the line.

A new boiling water reactor (using nuclear super-heat) will be started during 1960; but a proposed heavy water natural uranium reactor probably will be swallowed up in controversy on Capitol Hill.

What Congress will do may be tipped off by the leaning of Chairman Chet Holifield of the Joint Committee on Atomic Energy. Held in check last year by the Democratic leadership's desire for passage of only "possible legislation" without Ike's veto, Holifield's liberal attitude now may be given free rein.

VI. Public Works Outlook

Several controversial projects will be pushed in 1960—by different groups and in different forums. They include: High Mountain Sheep, Rampart, Burns Creek and Hoosier power projects.

• Burns Creek, a 90,000-kw federal dam proposed for the Snake River in Idaho, cleared the Senate last year, and its auhorization bill is now pending before the House Interior Committee where funds have already been enacted.

The $45-million dam—almost entirely allocated to power use—is planned as a part of the Palisades project, but critics point out that it actually would be a drain on the feasibility of Palisades. Without Palisades, Burns Creek would not be feasible in itself.

A last-minute attempt to sneak the Burns Creek authorization bill through the House Committee failed in late 1959, and a major fight in that body should develop shortly after the session begins.

• High Mountain Sheep, a $178-million dam on the Middle Snake, will come up for hearings before the FPC a little later in the year. Public power supporters will fight the proposed dam—to be built by Pacific Northwest Power Co—on two grounds: (1) It would preclude a more favorable project at the Nez Perce site; (2) no dam of high Mountain Sheep's size (690ft) should be built until better fish facilities are developed.

The proposed dam (ultimate capacity of 1,750,000 kw) has a good chance of approval, however, because of a recommendation for its construction by the recent Army Engineers' report on the Columbia River basin.

• Rampart Dam on the Yukon River, Alaska, might cost $1-billion, produce more than 5-million kw of power, create a lake in excess of 10,000 sq miles. It's in the beginning stages, but don't discount its chances. Public power supporters, flush with information on U.S.S.R. progress in EHV and hydro are expected to push Rampart as both feasible and necessary.

• Hoosier Electric Energy Co-op Inc, still has pending before the REA its record $54-million loan application to build a 198,000-kw steam plant. The co-op's first application (a record $42-million in 1957) was turned down for lack of sufficient information after co-sponsoring firm, Richards & Associates, cancelled plans for an aluminum plant nearby taking a block of Hoosier power.

The present application calls for all power to be used for the 16 sponsoring co-ops' 71,500 customers in 32 southern Indiana counties. The application pending before REA appears to be in order, and probably will be approved during 1960. A political explosion in Indiana may develop in the near future on behind-the-scenes activities surrounding both the previous and present applications.

• Federal construction of new power projects may get a big push. Interior Secretary Fred Seaton has admitted he will ask Congress for several new construction starts for Reclamation in fiscal 1961, and the Corps of Engineers is expected to do the same. And Congress, recognizing the local voter appeal of federal projects, should expand the list of new starts even beyond the number enacted in 1959. It now knows that President Eisenhower's veto is not insurmountable.

Generally, federal budgets for power-related activities will be greatly increased in the fiscal 1961 appropriation bills. REA probably will ask for—and get—$260-million for loans (compared with $136-million for the present fiscal year): The Army Engineers' budget should top $1-billion for the first time vs $850-million and the Bureau of Reclamation should get at least $310-million ($250-million). The Tennessee Valley Authority, operating now on its own bond-financing program, will put at least 1.2-million kw of new power capacity into initial construction during 1960—to be financed from the new bonds.

VII. Advertising

Electric companies face the possibility of rulings in three or four government forums during 1960 on the issue of tax deductibility for advertisements in the area of politics. These include Internal Revenue Service, FPC, Congress and the U.S. Court of Appeals.

IRS held hearings in late 1959 on the subject of tax deductibility for certain contributions, including certain types of ads and dues to organizations engaged in political activities These hearings, although not recorded, produced protests from all of the 30 witnesses. IRS is now considering its proposed rule (1.162-15, C), and probably will defer final decision until Congress either acts on the matter or it is apparent that Congress will not act.

A ruling against utilities by the full FPC is expected in the spring —since all testimony by electric utilities was ruled inadmissable.

And an appeal to the U.S. Court of Appeals will follow promptly the FPC ruling. In this case, the FPC has ordered 76 electric companies to show cause why they shouldn't pay for their contributions to the ECAP out of surplus—"below the line"—instead of as normal business expenses.

NEES Chairman Disputes New England 'Decline'

Lost textile plants replaced by diversified white collar industries. NEES evolution keeps pace with area growth

Continued growth and progress in company operations and in general New England business conditions were forcast by Irwin L. Moore, chairman of New England Electric System, in a speech before the New York Society of Security Analysts recently. Disputing prophecies of doom for New England's economy, Moore asserted that its evolution from blue collar, one-industry area to a highly diversified economy with a heavy proportion of new research laboratories, electronics and plastics plants had upgraded the labor level, increased per capita income, and given the area a new economic stability. Accompanying this have been significant improvements in NEES power production efficiency, accounting methods and organization structure. Here are some of the highlights:

• From 1946 to 1958, system fuel use per kwhr decreased from 1.39 lb to 0.81 lb and is expected to drop to 0.79 in 1959. Fuel consumption for Salem Harbor Station, which produced 45% of all steam power in 1958, was 0.67 lb/kwhr.

• Site preparation is underway for a new $85-million, 450-Mw, two unit steam plant near Fall River, on a plot large enough to accommodate a 1,000-Mw station. Scheduled to come on in 1963 and 1964, the units will be immediately fully loaded and will phase out 230,000 kw which NEES will purchase from Niagara Mohawk in 1962 to 1964.

MOORE: Don't sell New England short

• Corporate simplification, has reduced the number of subsidiaries from 40 in 1949 to 14 in 1959. Five subsidiaries now supply over 85% of the retail electric customers. Further mergers are in prospect.

• NEES plans to acquire the outstanding 5% minority interest of common stock in the recently acquired Lynn Gas & Electric Co, the only subsidiary in which they do not own 100% of common stock.

• Since 1955, consolidated net earnings have increased approximately 33% to $16,816,000 for the last twelve months.

• Unification of all system engineering, purchasing, financial, operations along functional lines has enabled the company to more than double its volume of business in the past ten years without any appreciable increase in personnel.

• Preliminary figures for 1959 indicate an average rate of return of 5.5% for electric subsidiaries and 6.2% for gas subsidiaries. Earnings in 1959 are expected to be about $1.33 per share.

• As a result of recent security sales and a relatively low construction budget for 1960, NEES does not expect to market any securities until late 1960.

• Rate increases aggregating about $2 million became effective in 1958 and 1959. Recently completed hearing may increase revenues by about $370,000.

Important Stage Completed in Big Snowy Mountain Scheme

A new 80-Mw turbine at Tumut One power station is feeding additional power to the states of New South Wales and Victoria, and to the Australian Capital Territory. The unit, an important stage in construction of the Snowy Mountain hydro scheme, was completed eight months ahead of schedule at a cost of $28 million. The power station is 1,200 ft under the Australian Alps.

The largest dam of the scheme, the Eucumbene, already has been constructed. Built of compacted earth and rubble, it has a base half a mile thick and a height of 381 ft. Its 11 underground power stations will produce about 3,000 Mw.

DEDICATION CEREMONIES marked the coming on the line of the second unit of Tumut One power station

Technical Data on 50 AC Network

Number	Location and Operators	Year Installed	Frequency	Generators	Generator Impedances	Instruments per Generator	Low R/X
1.	Puerto Rico Water Resources Authority, San Juan (Formerly at M. I. T.)	1929	60	16	6	4	...
2.	Pennsylvania Railroad (Gibbs & Hill, Inc., N. Y. C.) R. L. Kimball	1932	440	6	..	1	...
3.	General Electric Co., Schenectady, N. Y., No. 1 Analyzer, J. B. Bunch	1937	480	18	..	2/3	...
4.	Public Service Electric & Gas Co., Newark, N. J., J. A. Casazza	1938	480	12	..	2	...
5.	Tenesee Valley Authority, Chattanooga, Tenn., V. J. Cissna	1938	440	30	12	3	...
6.	Bonneville Power Administration, Portland, Ore., No. 1 Analyzer, O. A. Demuth	1940	480	31	12	2	12
7.	Potomac Electric Power Co., Washington, D. C., W. W. Valentine	1941	440	6	..	3	...
8.	Public Service Co. of Oklahoma, Tulsa, Okla., Webster Allen	1941	60	20	20	1	all
9.	Purdue University, Lafayette, Ind., (Formerly at Westinghouse) S. W. Shields	1942	440	19	..	3	...
10.	Hydro-Electric Power Commission of Ontario, Toronto, C. K. Duff	1942	440	15	15	3	...
11.	Illinois Institute of Technology, Chicago, Ill., E. B. Eggers	1945	440	18	18	3	...
12.	University of Kansas Research Foundation, Lawrence, Ka., E. B. Phillips	1947	60	8	8	3	all
13.	City of Los Angeles, Dept of Water & Power, Los Angeles, J. W. Boehr	1947	440	18	18	3	...
14.	Georgia Institute of Technology, Atlanta, Ga, H. P. Peters	1947	440	24	24	4	...
15.	Texas A & M Research Foundation, College Station, Texas., L. M. Haupt	1947	440	24	18	3	...
16.	Bureau of Reclamation, Denver, Colo., R. D. Goodrich	1948	480	18	..	3	12
17.	Pacific Gas & Electric Co., San Francisco, Cal., J. Quan	1948	440	18	18	4	...
18.	Baltimore Gas & Electric Co., Baltimore, Md., G. F. Renoff	1948	440	21	21	3	...
19.	General Electric Co., Schenectady, N. Y., No. 2 Analyzer, J. B. Bunch	1949	440	18	12	3	...
20.	University of California, Dept of Engineering, Los Angeles, F. W. Schott	1949	480	6	6	3	...
21.	Iowa State College, Ames, Iowa., W. B. Boast	1950	10,000	16	16	3	all
22.	Commonwealth Edison Co., Chicago, Ill., A. J. Krupy	1951	440	18	18	4	12
23.	The Detroit Edison Co., Detroit, Mich., A. K. Falk	1951	60	41	71	3	yes
24.	The American Electric Power Service Corp., N. Y. C., C. A. Imburgia	1951	480	16	..	3	...
25.	Northwestern Technological Institute, Evanston, Ill., J. E. Van Ness	1951	120	12	..	...	all
26.	University of Illinois, Urbana, Ill., P. R. Egbert	1952	10,000	20	20	2	all
27.	Long Island Lighting Co., Hicksville, N. Y., J. L. Davidson	1952	60	12	12	3	...
28.	B. C. Engineering Co., Ltd., Vancouver, B. C. Canada, L. A. Taylor	1953	440	12	12	4	...
29.	Northern States Power Co., Minneapolis, Minn., D. W. Angland	1953	60	21	21	3	...
30.	The Franklin Institute of Pennsylvania, Philadelphia, Pa., W. A. Hopkins	1954	440	28	30	4	...
31.	Boston Edison Co., Boston, Mass., F. J. Sherman	1954	60	15	15	3	all
32.	Southern California Edison Co., Los Angeles, Cal., H. Wood	1954	440	12	12	4	...
33.	Syracuse University, Syracuse, N. Y., L. E. Lingo	1954	480	21	..	3	...
34.	Cornell University, Ithaca, N. Y., (Formerly at Westinghouse) L. B. Spenser	1954	440	18	..	4	18
35.	Westinghouse Electric Corp., East Pittsburgh, Pa., O. J. Wallace	1954	440	36	36	4	...
36.	Bonneville Power Administration, Portland, Ore., No. 2 Analyzer, O. A. Demuth	1955	480	21	18	2	...
37.	I-T-E Circuit Breaker Co., Philadelphia, Pa., S. E. Zocholl	1955	60	24	24	3	all
38.	University of Wisconsin, Madison, Wis., D. K. Reitan	1955	440	15	15	4	...
39.	Union Electric Co. of Missouri, St. Louis, Mo., G. S. Whitlow	1956	60	21	..	3	all
40.	University of Missouri, Columbia., J. C. Hogan	1956	440	18	18	4	...
41.	Minkota Power Cooperative, Inc., Grand Forks, N. D., J. R. Grunenwald	1956	60	9	9	3	...
42.	Kentucky Utilities Co., Lexington, Ky., W. B. Bechanan	1957	60	15	..	3	all
43.	Pennsylvania State University, University Park, Pa., P. E. Shields	1957	440	12	12	3	...
44.	Rural Cooperative Power Association, Elk River, Minn., A. J. Bailey	1957	60	12	12	3	...
45.	University of Alberta, Edmonton, Alberta, Canada, R. E. Phillips	1957	500	12	12	3	...
46.	Cleveland Electric Illuminating Co., Cleveland, Ohio, A. L. Miller	1958	440	15	15	3	...
47.	Fast River Electric Power Co., Madison, S. D., (At S. D. State College) E. Dill	1958	60	9	9	3	20
48.	Lehigh University, Bethlehem, Pa., A. R. Miller	1958	60	6	..	3	all
49.	The Manitoba Hydro-Electric Board, Winnipeg, Manitoba, L. A. Bateman	1959	440	12	12	4	...
50.	University of Michigan, Ann Arbor, Mich, J. J. Carey	1959	440	4	4	3	...

REMARKS

3. Swing curve calculator, automatic load control on generators.
5. 8 auxiliary high impedance units.
8. 90 fixed impedances for line sections.
12. Ten 25% reactors, ten 25% resistors, ten 25% capacitors excluding units, 4 metering cords.
15. 2 instruments and control desks.
16. Time clock to turn on equipment for warming. Uncalibrated potentiometer and fixed capacitor in each load unit for very small power factor loads.
17. Automatic scale selector.
18. Generator swing curve calculator.
19. Swing curve calculator, interconnection with network analyzer 3.
21. 2-watt regulators, 2 control-metering desks, 24 metering jacks, 15 bus connections, 50 portable capacitors.
22. Automatic scale selector.
24. 40 metered jumpers.

Today's 50 AC Network Analyzers

Ten new a-c network analyzer installations round out previous facilities available for solving power problems

DR ERIC T. B. GROSS, Professor of Power Systems Engineering, Illinois Institute of Technology, Chicago, Ill.

Based on a paper presented before the 1959 American Power Conference

It should not be assumed that digital computers will rapidly become the exclusive tool for the solution of all power system problems now being handled on network analyzers. Digital computers and ac networks analyzers supplement each other. Each has its selected application. Today, however, digital computers are being given the preference where great accuracy is essential, as for example in precise loss calculations. In spite of such preference as this, network analyz-

Analyzers in the United States and Canada

Low R/X	Impedances	PI Lines	Load Units	Load Adjusters	Load Voltmeters	Capacitors	Large Capacitors	Auto Transformers	Mutual Transformers	Recording Table	Transient	Analog Computers	Digital Computers
...	86	..	40	..	..	40	15	14	2	...	...	...	...
...	168	..	40	..	..	12	..	14	16	...	...	...	...
...	100	50	50	48	48	100	4	24	15	...	yes, 2	yes, 2	yes
...	150	..	50	50	50	42	..	22	22	...	...	...	yes
...	174	..	68	48	..	58	..	36	34	...	...	...	yes
12	130	70	70	70	70	54	6	20	16	...	...	...	yes
...	52	..	18	18	..	12	0	6	8	...	...	...	...
all	60	84	76	..	..	..	10	40	..	...	...	...	...
...	144	..	56	56	56	60	4	36	30	...	...	...	yes
...	83	..	32	32	..	36	..	18	11	...	...	...	yes
...	76	60	64	64	64	60	..	36	24	yes	yes	yes	yes
all	56	..	32	32	..	12	..	8	8	...	...	yes	...
...	120	..	40	40	40	36	6	16	18	...	...	...	...
...	88	104	76	76	76	30	..	30	18	yes	...	yes	yes
...	174	70	100	100	100	56	..	24	24	yes	yes	yes	yes
12	156	66	64	64	64	132	4	36	14	...	...	...	yes
...	132	32	48	48	48	48	..	24	12	...	...	...	...
...	169	9	65	65	65	24	6	30	20	...	...	...	...
...	96	50	56	56	56	100	4	24	15	...	yes	yes	yes
...	50	..	16	..	..	35	..	8	4	...	...	...	...
all	12	128	66	66	66	..	24	28	20	2	...	...	yes
12	72	48	60	60	60	24	4	30	12	...	...	...	yes
yes	120	134	90	90	90	96	16	102	8	yes	yes	yes	...
...	34	120	60	60	60	144	4	32	16	...	...	...	...
all	99	..	40	..	..	30	..	18	15	...	yes	yes	yes
all	...	152	56	56	56	28	..	34	24	yes	...	yes	yes
...	70	70	70	70	70	..	10	35	5	...	...	...	...
...	80	20	42	42	42	30	..	15	8	...	...	...	yes
...	55	110	55	110	110	110	10	55	5	...	...	...	yes
...	198	72	90	90	90	90	..	54	18	yes	...	...	...
all	152	76	76	76	76	14	..	38	20	...	...	...	yes
...	54	40	39	39	39	24	4	12	20	...	yes	...	...
...	125	75	72	72	72	150	..	32	50	yes	no	yes	yes
18	128	40	48	48	48	48	..	36	36	yes	...	...	yes
...	120	187	108	108	108	48	8	72	56	yes	...	...	...
...	130	130	70	70	70	32	6	30	16	...	yes	yes	yes
all	88	102	96	96	96	48	..	48	24	yes	...	...	...
...	75	60	50	50	50	48	24	36	25	yes	yes	yes	yes
all	72	99	60	60	60	14	10	32	20	yes	...	...	...
...	75	48	48	48	48	18	..	18	18	yes	...	yes	yes
...	96	52	44	44	44	52	..	22	..	...	...	...	...
all	68	99	76	76	76	24	..	32	20	yes	...	...	...
...	66	24	33	..	33	18	..	18	8	...	yes	yes	yes
...	92	46	46	46	46	46	7	23	10	...	...	...	...
...	84	24	24	24	24	48	..	12	16	...	...	...	yes
...	180	24	36	36	36	36	..	12	48	...	...	...	yes
20	40	40	40	40	40	40	..	20	0	...	...	yes	...
all	16	6	16	16	..	4	..	..	8	...	...	...	...
...	138	24	72	72	72	60	..	9	18	yes	...	...	...
...	9	..	3	3	3	6	..	4	4	...	...	...	...

25. SM analog for transient problems.
26. 16 metering circuits, 8 bus sectionalizing switches.
28. Metered jumpers.
30. 2 metering—control desks, 30 metering jumpers.
32. Automatic scale selection, regulators on 6 generators.
33. Automatic control for 5 generators and 8 loads.
34. Automatic scale selectors, 2 desks.
35. Watt regulators on all generators, automatic scale selection and recording equipment.
36. Automatic load adjusters.
37. 3 extending reactors, 3 extending resistors.
38, 40. Automatic scale selector, watt regulators for generators.
42. 20 metered jumpers.
45. 24 metered jumpers.
46. Automatic scale selection, all generators with watt regulators, 15 metered jumpers.
49. Automatic scale selectors, watt regulators on generators, 50 metered jumpers.

Play Key Role in System Design

ers seem to be holding their own.

Periodic publication of a summary giving the technical data of network analysers installed and operating in America has proved to be welcome by system planning engineers and others using this tool. The accompanying tabulations contain data on 50 network analyzers, built since the first installation at Massachusetts Institute of Technology in 1929, which are now available and in use.

The ten newest installations are in their majority smaller boards; some of the boards installed earlier have been enlarged during this period, so that the relative distribution of sizes remains roughly the same. Many automatic devices have been added to old and new analyzers.

It should be noted, however, that this listing does not include miniaturized ac network analyzers; however, various manufacturers have delivered such portable equipment to a number of utilities.

Limited Water Supply Fights

Deluge-type system at two AEP substations guards 345-kv main transformers; the design can accommodate expansion

G. D. WEATHERFORD, Fire Protection Engineer, American Electric Power Service Corp, New York, N.Y.

R. J. GRAY, Contracting Engineer, Grinnell Co, Inc., Providence, R. I.

Limited water supply fire-protection systems have been installed for transformers at two large substations on the American Electric Power System. They are at places where the only water supply is a small well for sanitary facilities.

Loss of either substation would be roughly equivalent to loss of a major generating unit. The stations have 345-kv switchyards with four to eight 345-kv oil circuit breakers connected, through 345/138-kv autotransformers, to 138-kv switchyards. Each substation's two transformers, 150 to 200 Mva in size and connected solidly in parallel, operate as a unit.

For these transformers, the fixed automatic fire protection was furnished by Grinnell Co's Selfcon water spray system, a deluge type, using a nitrogen-pressurized water supply. The water when sprayed has an extinguishing action on burning transil oil and a cooling effect on metal. Thus the probability of reflash is minimized.

Of the various types of limited supply systems suitable for transformer fire protection, water spray was considered as offering the most advantages. Extinguishing time averages 5 to 30 sec on transformer test fires. As the systems were designed for a 2-min water supply, the theoretical safety factor is four.

Acceptance-test results showed the feasibility of protecting large electrical equipment with such a system, provided proper consideration is given its design. Its relatively low cost recommends its use in isolated areas.

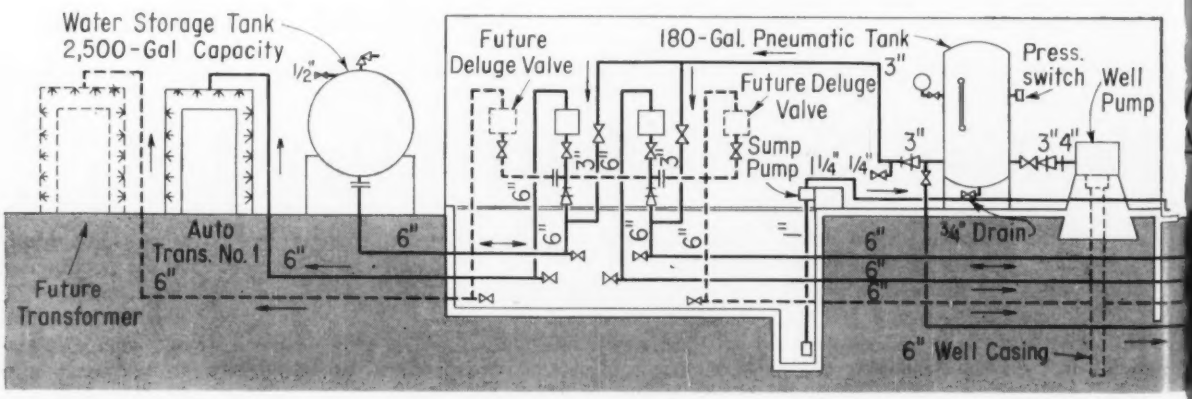
Piping for the water spray system around the transformer is of two-loop design. The upper loop is slightly below the top of the transformer shell; the lower about midway down the transformer. The transformer's size, together with the need to maintain proper electrical clearances made it necessary to locate the nozzles lower than is required to protect the top of the transformer. A row of nozzles directly across the transformer top between the high and low-voltage bushings was added to protect this area.

Pressure at the most remote of the 75 nozzles is 50 psi, giving a flow rate of 1,155 gpm. The water supply is so arranged that each transformer will receive one automatic shot, the second shot being held in reserve for manual discharge.

The system was so designed that each transformer is fed from a separate 2,500-gal tank. These water tanks, 4 ft dia by 29 ft long, are mounted on concrete saddles about 18 in. above grade. Although the separate water tanks would allow their elimination, deluge valves were installed because by merely adding more of them, along with the connecting piping, the system can be extended to protect two transformers planned for the future.

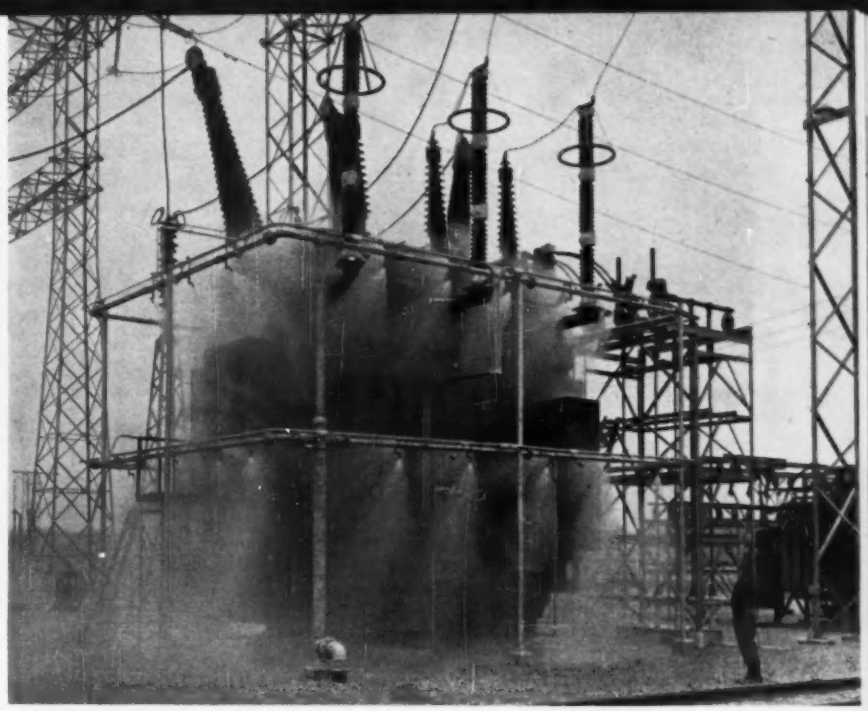
Each water tank is pressurized by a bank of 15 nitrogen-filled cylinders (the sort usually containing carbon dioxide), each cylinder holding 220 cu ft. These were used to utilize the automatic discharge features which are not available on standard nitrogen bottles. They are along each side wall of the valve house, adjacent to their associated water tank. Another 15 stand free in the center of the valve house for fast replacement. Each cylinder has a pressure-operated head, and two in each bank have gun-powder-actuated discharge plugs which are fired by an electric filament. A high-pressure manifold, connecting the bottles, supplies a low-pressure manifold through eight pressure regulators. The water tank is pressurized by two 2-in. connections, one from each end of the cylinder manifold. Relief valves are included.

The pressure regulators are set to give whatever pressure is needed



FLOW DIAGRAM shows the water spray system designed so each transformer is protected by a separate 2,500-gal tank. Tanks are mounted above grade. Deluge valves and piping can be added to protect more transformers

Fire Loss



FIXED AUTOMATIC FIRE-PROTECTION for 345-kv autotransformers is of the deluge type, using nitrogen-pressured water supply. Nozzles on piping looped at two levels spray the equipment and surrounding ground area efficiently

in the water tank to provide the 50 psi at the most remote nozzle. The 6-in.-dia deluge valves are fed from a common 6-in. manifold, into which each tank feeds through a 6-in. line and check valve. The latter prevents water from flowing back from one tank into another. Future transformers will be protected by extending this manifold to accommodate additional deluge valves.

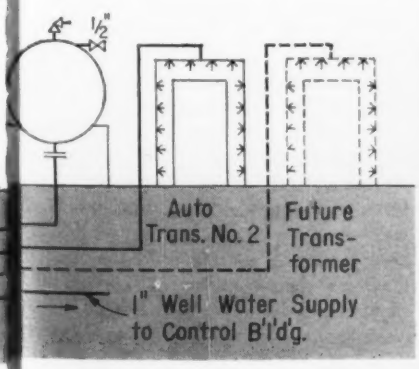
The detection system uses 250-v dc electric thermostats which work on a rate-of-rise principle. Around each transformer are 30 detectors to assure quick detection. A modified Underwriter's electric control operates the deluge valve, and a contact from the valve, in turn, pressurizes the appropriate bank of nitrogen cylinders. Once these are opened, the cylinders remain so until empty.

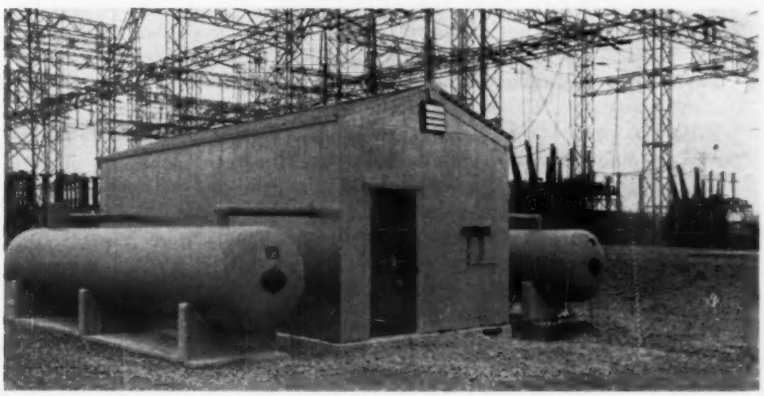
Gas requirements were calculated to provide an oversupply for purging the system after the water tank is empty. The piping is sloped from the transformers to the deluge-valve house and the 1-in. drains in the valve pit under the valves. This arrangement assures a dry piping system. A small sump pump in the valve pit removes accumulated water.

A shut-off valve has been installed ahead of the deluge valve, and a tamper switch on the yoke supervises the position of the valve gate. The spray system, itself, is supervised against operation and trouble by means of the telemetering system. The transformer "operating" alarm is received at the nearest supervised location on the telemetering critical alarm. As the substations are unattended, personnel must be dispatched to determine conditions upon receipt of either alarm.

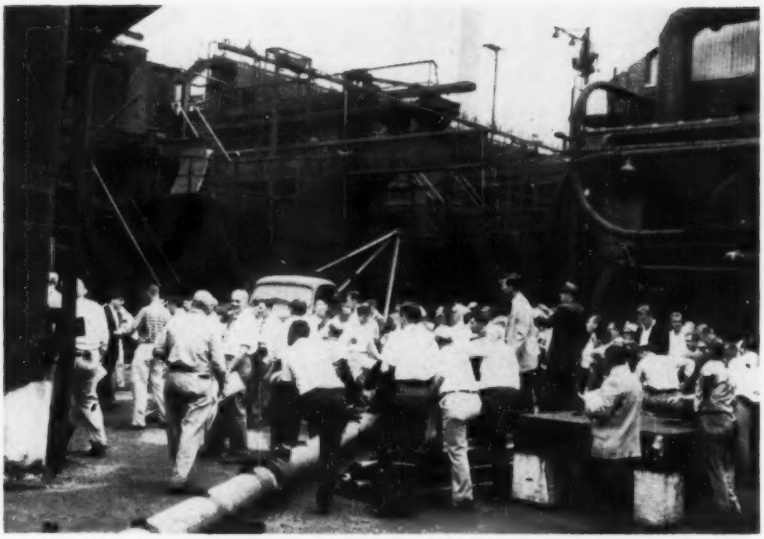
The fire-protection system is designed primarily for automatic operation. If the second tank is needed, it can be discharged through the proper deluge valve for a manually-operated second shot. This can be done through the manual release on the second tank of nitrogen cylinders. As the deluge valves are on a common manifold when the second tank is pressurized, the water will flow through the open valve onto the proper transformer.

Wheeled portable equipment in the yard can be used for mop-up action. Electric pushbutton stations outside the valve house can operate either of the two systems.





WATER TANKS are mounted on concrete saddles on both sides of valve house. Nitrogen bottles inside pressurize the water at 50 psi minimum to nozzles



Auction Provides Higher Prices In Less Time at Coke Plant Sale

The sound of an auctioneer's gavel has struck a responsive chord with the management of New Jersey's Public Service Electric & Gas Co.

When the company decided to close down its Camden, N. J., coke plant by stages, it encountered the difficulty of disposing of plant machinery and equipment available for immediate sale while retaining equipment needed for interim operations.

Public Service learned that a utility in a neighboring state, when faced with the same problem, had liquidated its plant piece by piece at private sales, but had found that the operation was costly, unsatisfactory, and took two years.

A company executive recalled an industrial plant public auction having taken place in the Camden area several years before. Samuel T. Freeman & Co of Philadelphia, the firm which had conducted the previous auction, was contacted. It surveyed the plant, estimated the probable return from a public sale, and mapped out a time schedule to fit in with Public Service's plans. Charles B. Kelly, the power company's division plant superintendent, was the man whose good memory paved the way for the auction. He talked the idea over with William J. Lutz, chief engineer of the gas department, before negotiations began.

Advertisements in trade journals and newspapers and direct mail brochures brought representatives of some of the nation's larger companies to examine the machinery and equipment during an exhibition period prior to the sale.

Over 150 people attended the auction which took place June 23. All 559 listed lots were auctioned off in spirited bidding.

Public Service felt the auction benefited it in the following ways:

- Net amount realized was more than could have been obtained through either private liquidation or scrapping, because competition among buyers boosted the prices.
- The entire process took weeks instead of years, proceeds were obtained shortly after the auction, and removal was effected promptly.
- Expense, responsibility, and liability of dismantling and removing the equipment was borne by the purchasers. Public Service was relieved of the cost of scrapping or removal.

Public Service has begun preparing plans for a second auction when step two of its plant closing is completed.

Cutback of Co-op and TVA Programs Urged by Stans

Budget Director Maurice Stans has re-emphasized the Eisenhower Administration's stand against inflation, calling for a halt or reduction in those federal programs which no longer are necessary to purposes for which they were created. Rural electrification and "public works projects like the Tennessee Valley Authority" were given as examples.

In the current *Annals of the American Academy of Political & Social Sciences* Stans claims that, although a balanced budget goal can't always be achieved, matching surpluses should be built up in other years to meet deficits. He also criticized the government's "temporary" spending programs during recessions, because of the difficulty in terminating them.

Citing rural electrification as a federal program that has outlived its original purpose, Stans predicted that future demands for REA funds will continue to grow. "The reasonable approach" would be that co-ops should obtain part of their financing from other-than-government sources.

Lack of Interest Shelves Town Development Contest

Carolina Power & Light Co has discontinued a seven-year old community development contest until "more interest in the competitive aspect justifies resuming it." This was announced by E. N. Pope, advertising manager and originator of the "Helping to Build a Finer Carolina" contest theme, which, incidentally, still will be used in future advertising.

The company paid out over $64,000 in prize money since the contest began.

Lack of interest in the contest will not affect area development efforts. CP&L has specialists "who will work with communities that have a special interest in a particular local development," Pope said.

A six-year old "Finer Farms" competition also has been suspended "until a new plan can be developed which will stimulate more widespread interest," Pope said.

Survey of the '60's: People, Production, Power...

Swiftly rising loads, pyramiding technology to characterize the industry in decade ahead

In these last days of the "Fabulous Fifties," a reporter of the utility scene is tempted to look backward—to review with satisfaction—the tremendous advances by the industry over the decade (p 58).

When one takes the luxury to ponder, probably his most significant impression would be of a perceptibly shrinking time scale. For he would see the *rate* of commercial and technological changes in our business increasing geometrically with time.

Witness only the Fifties' gains in supercritical steam units, nuclear power, and EHV. Note the coming to maturity of air conditioning. The Forties offered nothing like these.

Surely the Sixties will follow the trend of evermore swiftly rising loads and pyramiding technology. The public has accepted electrical living as a way of life, and a rising tempo of basic and applied research has laid a firm and strengthening support for the technology to handle the loads economically.

Thus Electrical World's editors, at decade's end, glance backward but briefly. Their attention is drawn to the future, to the glamorous decade ahead.

Forecasting is our work, so it's easy to slip into a frame of mind to soothsay the Sixties. In what follows, we'll try to shake the shackles of conventional prophesy and essay a word picture of some of the events and trends we think will be important to the electrical power business.

First off: **People** will call the shots on growth. And **People** in the business will make the crucial decisions needed to meet this growth.

So we'll start—and end—with **People.** In between, we'll consider the consumer and the national production to supply him. We'll translate this into load patterns, and inspect the systems, generation, transmission, and distribution changes we expect the Sixties to reveal. We'll probe the research underlying the technical trends.

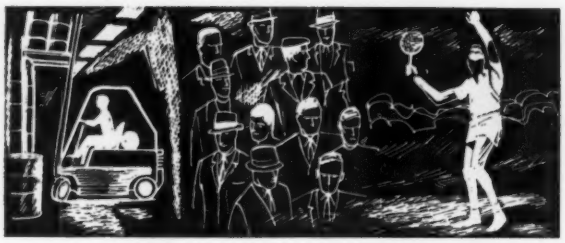
Then, because they have the potential of changing the utility picture even more than load growth or engineering, we'll turn to finance, regulation, public relations, and politics.

Though prophesy need have no bounds, we'll limit ours to the American scene, though we're acutely aware that, like time, the world is shrinking. Foreign developments undoubtedly will touch us, but we'll take a shortcut and factor in their effect without specific mention.

Survey of the '60's

People

More People



Shifts in age groups further emphasize the bright prospects for big market expansion

The American consumer—his numbers, his economic well-being, his philosophy, his attitude and his decisions—will shape and guide the decade. For it is he for whom our whole economy operates. Thus, in this brief Survey of the Sixties, people are our first concern.

From the U. S. Census Bureau and the McGraw-Hill Dept of Economics come authoritative projections about people and their probable standard of living over the next decade.

Lacking war, pestilence, or abrupt change in birthrate, there will be a very sizeable population increase—a rise of some 34 million people. In terms of markets, that is enough new customers to create nearly 3½ new ones with the present population of the New York metropolitan area, or 8½ new ones the size of present-day Georgia.

But the vast population increase portends much more than just a larger number of people. Of just as much importance to industry generally, and the electrical industry especially, will be the sizeable shifts within age groups.

Nearly two-thirds of the 34 million will be accounted for by younger people—those up to 24 years of age. In itself, this spells the need for many more schools, and for substantial numbers of houses to accommodate the family formations of our young couples.

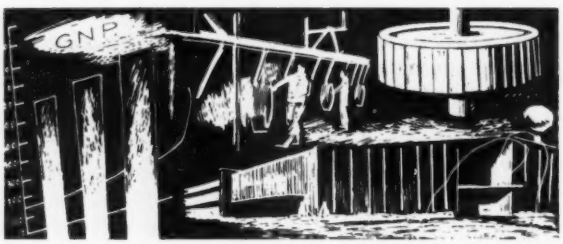
There will be a slight increase in the proportion of older people, so that by mid-1970, those 65 and over will comprise over 9% of the population. Many of these will have their homes free and clear; drawing money from savings in the form of government insurance and pension funds, they'll continue to use present appliances and probably have enough disposable income to acquire a modest group of additions.

But it is the working force group (those 24 to 64 years of age) that probably will have the biggest impact on the economy. This age group, at the end of the Sixties, will make up about the same proportion of the total population as it now does, roughly 37%.

But by drawing from the older and younger age groups, the nation will be able to muster a much more impressive gain in the number of persons employed in

Production

Gross Product



Consumer will call the turn, but productive capability will be able to meet rising demand

The decisions of the American consumer as to the disposal of his income will have a direct affect on his home kwhr usage. But of much greater importance to the utility industry is his leverage on national production—the output of goods and services. Not only does this spell added industrial and commercial load, but it sustains the flow of money which underwrites the economic health of the business community.

By study and projection, the McGraw-Hill Dept of Economics has sketched this broad outline of the production picture for the decade ahead.

Gross National Product will rise from $480 billion in 1959 to $700 billion in 1969—up 46%.

This increase in production will be accomplished by 21% more employees, each working 2.2 fewer hours per week, but earning 18% more per hour.

Total goods and services produced in 1969 will go 66% to consumers, 18% to government, and 16% to business investment in pretty much the same proportions as in 1959. Only the government share will be trimmed, and that little.

What makes us sure the U. S. will have the capability of attaining this production level by decade's end? Well, from 1930 to 1957, productivity increased, on average, about 2½% annually. We bettered this for the ten years immediately following World War II, but slowed down a bit in 1956 and 1957. With continued technological improvements during the Sixties, it is reasonable that average national output per manhour, the key factor in projecting growth, will continue to rise at a

Spending More Money—For What?

productive pursuits. The gain will be on the order of 14 million during the 10 year period, bringing total employment in 1969 to 80 million.

Of equal importance will be the jump in per-family disposable income from the present $4,900 to $6,250, up 28%. And this is expressed in fixed 1959 dollars.

This is a remarkable increase in buying power. In effect, it will sustain the constant expansion of the American middle class which began before the war.

The prime question is: what will this vastly enlarged public with much fatter incomes choose to do with all these dollars?

Let's look at the motivations behind spending for what we've come to call "electric living." Most of it revolves around the home, of course. The pattern of American life, cynically described as "materialistic," has put continued emphasis on easier, more gracious home life, and this has played nicely into the residential load growth situation.

We believe this trend will continue, despite a predicted shrinkage in the average work week from 38.7 to 36.5 hours which means greater leisure time. Although a proportion of this new free time will be spent away from the home in pursuit of sport, culture, and travel (relatively poor load-building avenues), we see do-it-yourself and hobbywork trends continuing to hold people at home an equal amount.

Casting far from our sphere of economic projections, we hazard a thought that the end of the decade will see the beginning of a shift in emphasis from the materialistic toward the cultural. With the trend toward higher education, this is inevitable. But don't count on it to make much of a dent in residential load building in the next ten years. "Keeping up with the Joneses" will be with us for a long time.

There will, of course, be recessions. But the economy is acquiring a large number of built-in and automatic stabilizers, beyond the scope of this article. The efficacy of their performance was shown during the 1957-58 slump, during which the U. S. consumer, on average, barely tightened his belt. McGraw-Hill's economists are confident this will be the rule, not the exception, in future.

People will elect to save some of their disposable income, of course. They will become more investment-conscious, a lucky thing, since American industry in general and the utilities in particular will need large amounts of new capital to sustain the expansion of the decade.

There is the possibility, too, that taxes will take a slightly lower percentage of personal income if any progress is made in agreements limiting military armaments. A part of this tax savings would be diverted to consumer items—but a part would also find its way into savings accounts.

In summary, a larger number of American people will have much more money to spend, and they'll be no tighter on the purse-strings than they are now.

to Rise 46%; Research, 100%

rate averaging around 2½% per year.

Couple this with the expected increase in labor force (a dependable forecast, since the people who will comprise it in 1969 are already born), and we have a gross national product of $700 billion at the end of the decade, providing always the consumer demand is there.

In the field of consumer demand, there is likely to be tremendous growth in housing and in housing standards. The present trend is such that non-farm dwelling units will increase from 51.2 million in 1959 to 59.5 million in 1969, a 16.2% gain. This boost will be aided by the growth of two-house families. To get there, new housing starts will rise from about 1.3 million per year now to over 1.6 million by 1969.

Mass production methods—whether pre-fabrication or mass assembly at site—will hold the cost line, but higher incomes will demand higher quality. In general, we can say homes of the next decade will be bigger, better designed, and better furnished than those of the present one.

A key ingredient in our optimistic view is the growing impact of the research and development of new products. In the past five years, expenditures for R&D have nearly doubled.

So has the sale of new products; but a commonly-accepted rule-of-thumb is that an average seven years elapses between start of research on a new product until it is marketed. Thus we see that the doubling of new product sales in the last half decade is due to efforts often originating back in the late Forties. And the present relatively high level of R&D won't be reflected in new products until well into the next decade.

Further, research and development spending will continue to increase. An informed estimate puts the 1969 figure at about double the $12.2 billion spent in '59. It is evident the impact on new product evolution will be felt more strongly as the decade progresses.

To produce these new, enticing products and to meet boosted demands for the existing ones, we will need to increase manufacturing capacity half again by the end of 1969.

Add to this almost-certain government programs in schools, highways, recreational facilities and defense, and you almost certainly spell a continued high demand for goods and services.

Survey of the '60's

Power New Engineering

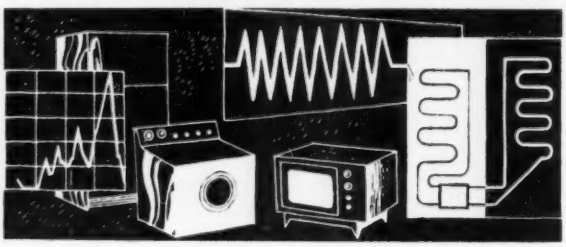
For the electrical utility business to cope with the huge boosts in population and gross national production depicted above for the decade of the Sixties, it will have to do quite a bit of expanding.

The growth of our industry over the decade is assured. It will increase total kwhr sales by some 119% by 1969. To produce and distribute this energy, gross utility plant will more than double over the decade.

Though we are confident of this physical growth, what interests us even more is its pattern, and the engineering approaches which will be used to attain it.

We are convinced that there must—and will—be perceptible changes in the approaches to designing power systems. The trend already has begun, with development of what some engineers fortuitously call the "systems concept"—a concept with the disarming simplicity

Load Patterns Electric Heating



But total load growth—not radical change in load pattern—will provide the challenge

Before we can inspect the shape of the electrical utility systems of the Sixties, it would be well to take a look at the load patterns which will develop.

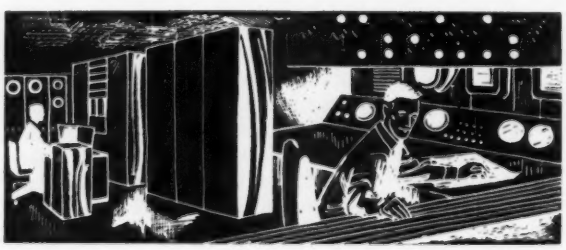
The proportion of total energy sales which will be allocated respectively to industrial, commercial, residential and "other" customers won't change markedly from what it is today. By 1969, industrial loads will account for 47% of total sales, compared to 49% today. Residential customers' requirements will rise from 28 to 30% of the total. Commercial will about hold even, percentagewise, as will "all other."

By the end of the decade, the average residential customer will be using about 6,600 kwhr annually, compared to almost 3,600 this year. To achieve this level of usage, residential customers will have to take on new load at a much faster rate.

This will almost certainly be the case. The new appliances which will hit the market, such as completely automatic home laundries, ultrasonic and electrostatic cleaning devices, electroluminescent lighting, and reversible (Peltier effect) integrated heating-cooling devices will see to it, even if electric space heating didn't loom large on the horizon.

Electric space heating will provide the greatest effect on residential load. Today there are only about 600,000 electrically-heated U. S. homes. In most areas, the utility can count on such a home for about 20,000 annual kwhr of revenue. Thus about 12 billion kwhr now are used annually in electrically heated homes—including the range and water heater which almost al-

Systems Revolutionary



Power pools will be vastly expanded and units of 1,000 Mw will be on order in '60's

On the eve of the Sixties electric utilities face an era of change from which power systems will emerge dramatically altered in character and concept.

The new decade will bring multi-million kw systems which will be the integrated and optimized product of a revolution in planning rather than "random" assemblies of individually-optimized power plants, substations, and transmission networks.

New and highly-sophisticated analytical methods, already available, will team probability mathematics with digital computer techniques to provide the comprehensive and far-sighted vistas of future load and capacity relationships vital to such a planning concept.

Concept Can Meet Challenge

of considering a power system as an overall entity, not a thrown-together collection of power plants conventiently tied together with transmission.

Validity of this concept, obviously, has been known for years. But it took the availability of the modern computer to permit it to be exploited.

Engineering *can* meet the challenge of the decade. If bounds of conventional thinking can be transcended to permit the conceptual and technical tools to be brought to bear, the battle will be half won.

But only half: for the future of the utility industry is entwined in non-engineering matters such as finance, regulation, public relations and politics.

Yet these primarily affect how much it costs to do the job, and perhaps who does it. So first let's turn our attention to the technical aspects at hand.

Will Help Shape Demand Curve

ways fall electric when space heating is on the line.

By 1969 these homes will increase almost eight-fold to about 4 million. The usage of these homes, conservatively assuming the average holds constant, thus will account for around 100 billion kwhr. And only 172 billion kwhr was sold to all residential customers in 1959!

The movement toward electric heating will be expedited by the narrowing price differential between electricity and alternate fuels. While the price of residential electricity has about held even over the past decade, gas and oil prices have trended upward. There is no reason to doubt continuation of these trends. Electric rates will rise, but not as fast as competitive fuel prices, which will be pressured by higher production and transportation costs as well as growing demand by chemical plants to use them as raw materials.

With the narrowing differential, it will be possible in more areas to sell electric heating on economic grounds. Now, in most areas, it sells on convenience, cleanliness, controlability and safety, not on price.

There's much controversy over what addition of substantial quantities of electric heating load will do to load factor. Of course, there's no one answer that will hold for all utilities. In many areas, heating will balance off the still-growing summer demands of air conditioning, but in others, it will set new demands much higher. Only the future will tell what the overall effect will be, but new testing, sampling and computing techniques may give the answers much sooner.

In our view, electric heating will have a vital part in shaping the demand curves, but then, so did air conditioning, which has proved after all to be acceptable.

In the industrial area, continued higher first costs for plant plus increasing automation will enhance the economics of 24-hour operation, so we expect to see load factors here move upward, providing a balance against the undoubtedly poorer load factors to be shown by residential customers.

We expect to see substantial expansion of sales to industrials which use electricity as raw material: the electrometallurgicals and electrochemicals, which have high load factors.

Overall, we believe it will be growth in total load, not radical change in load pattern, which will provide the real challenge to the systems of the Sixties.

Strides Seen in System Planning

Through use of mathematical models of load and capacity, the electrical and economic interrelationship of each new unit to the existing system, and that system to the future, will be clearly portrayed, as systems expand.

Among the more exciting products of these methods will be the accurate determination of the most economic system development pattern, including the precise sizing, timing, and location of power plants, substations, and transmission; and the determination, for the first time, of the dollar value of various degrees of service continuity.

How fast the revolution in planning will come about depends on how fast planners accept the "optimized system" concept that underlies it. Its advent is at hand, and full acceptance will occur before end of the decade.

Pressure on power systems will come from growth that will see the number of systems exceeding a million kw jump from today's 30 to more than 60. Generating capacity, which in this decade increased from 62 to 158 million kw, will top 335 million in the next.

Demands that the product of this capacity be ready, reliable, and reasonable in cost will stimulate an unparalleled growth in transmission within and among power systems. Today's 2,600 miles of 345-kv transmission will double in the next decade and lines of

460 kv and perhaps higher will be a functioning reality.

Existing system interconnections now tie together 85% of the generating capacity of the U. S. in groups of systems. Many of these interconnections form strong, working links, while others are emergency standbys only. These inter-system connections will be immensely expanded and strengthened in the next decade as the economic need to take fuller advantage of time and load diversity and to share reserves becomes more evident. Threat of governmental interference will hasten this trend.

Power pooling, today well-developed, will in the Sixties reach fuller flower, bringing with it a higher degree of service reliability among members, opportunities for investment economy through reductions in spinning reserve requirements and from use of larger units. There will be the start of pooling of pools, the first and most logical approach to regional and even nation-wide power grids.

The average size of U. S. steam power units today is approaching 100 Mw, and there is a 600-Mw unit on order. By decade's end, averaged installed size certainly will reach 150 Mw, average size of new units will top 230, and single units exceeding 1,000 will be on order.

The upward march of system, station, and unit size and growth of interconnections will put a bigger cost premium on operating errors, interruptions, and catastrophies. At least a partial solution will lie in the full acceptance, by the latter half of the Sixties, of completely automatic steam plants that can be started, operated, and shut down without human aid.

Thus steam-electric stations will follow the course toward complete automation and remote, unattended control pioneered by hydro plants and substations. It is doubtful, however, if major steam stations will be completely unattended, except experimentally, during the decade.

Automatic economic dispatch, already functioning on major systems predominantly based on steam, will be multiplied and extended into the smaller systems in the Sixties as the scope of power pool operation ex-

Generation

Unit and Station

Nuclear power will make up 3-5% of total; Peaking plants, exotic sources in picture

During the Sixties, conventional steam-electric stations will continue to comprise the bulk of generating capacity additions. Hydro will slip a little in proportion of total generation, though there will be a strengthening interest in pumped storage. Nuclear power will expand swiftly, but by 1969 still will be supplying only 3-5% of the utility industry's total generating requirements.

The pattern of conventional steam-electric developments wil be shaped largely by economics behind zooming site costs, water supply problems and increasingly rigid restrictions on air and water pollution. Beyond these, there will be new emphasis on adding low-capital cost plants for handling the upper 10-20% of the utilities' load-duration curves.

Toward the end of the Sixties, we look for the first application of one of the "exotic" methods of thermal power generation, probably the topping of an existing conventional cycle with a direct conversion method. This is contingent, though, on the early development of a practical, and economical power inverter for use with it.

Because of site and water supply limitations, unit and station sizes will continue their dramatic rise. To an increasing extent, the same forces, plus pollution restrictions, will dictate location of plants farther and farther from the load centers, placing an added premium on efficiency and increasing transmission loss penalty factors.

On the other hand, the comparatively level coal prices of recent years will continue, during the first half of the decade, to hold down pressure to boost efficiencies through higher pressures and temperatures. Delivered coal prices will be influenced strongly during this period by more use of transportation ingenuity, including coal pipe lines and favorable shipping contracts.

But by the latter half of the Sixties, upward pressures on coal prices again will be felt, steam conditions will resume their interrupted rise, and metallurgists will be spurred anew to broaden the versatility and reduce costs of austenitic steels, so vital to high-pressure, high-temperature steam cycles.

Meanwhile, rapid rise in oil and gas prices will see greater use of coal in western areas, with large plants located near strip mines and connected to the load via long, EHV transmission.

As base-load units get larger and costs rise, utilities will turn more to peak shaving stations. There will be real controversy among the proponents of small diesel or gas turbine units and those of larger, minimum cost "bare bones" steam plants. Use of more precise plan-

tends beyond regional and local limits. Economic dispatch controls will begin to operate entire multi-company pools. A significant advance will be made by the extension of economic dispatch toward integrating hydro and steam operation to get lowest overall cost and most efficient use of available water.

More highly developed techniques of weather forecasting, developed by government and private forecasters, will see accepted use by system operators late in the decade. These will provide more accurate load prognosis and optimum seasonal operation of hydro reservoirs.

With more accurate planning will come fuller acceptance of a new kind of low-cost power plant, designed specifically for peaking, to handle the top 10% of the load-duration cycle. Until now, lack of preciseness in carrying out projected plans has seen many plants designed for this service needed for uneconomic base-load operation.

Short circuits encountered on systems of the Sixties will increase sharply with boosted generating capacity and emphasis on interconnection. Circuit breakers capable of handling 50,000 Mva, double that available today, will be in service. High-speed relaying, one- and two-cycle breakers and faster reclosing will be the rule to provide stability demanded by higher line loadings. There will be a continuation of the trend to transfer tripping as use of multiple terminal lines increases.

Also, as transmission line capacity increases, with the upward march of voltages, power transformer ratings will climb. Top ratings upwards of 750 Mva are a reasonable expectation for the expanding power systems of the Sixties.

The incentive to reduced insulation, or BIL, will continue as long as voltages climb and interconnection of systems at EHV levels make savings attractive in the cost of units through reduced losses, lower impedance, and reduced weight. In fact, the Sixties will very likely see intensified pressure for reduced transformer BIL and a concentrated effort to get the improved lightning arresters to protect them.

n Sizes Will Continue to Rise

ning tools will help resolve the selection for each system's own peculiar requirements. Where available, pumped storage hydro will be applied to peak shaving, as well.

The first generation of computer-controlled, fully-automatic steam plants will have completed considerable experience time by the end of the decade, and second-generation plants will be coming on the line. The first blush of enthusiasm will be tempered, and attempts made to analyze cost savings based on all factors: increased efficiency, reduced manpower, and, probably the strongest (and the toughest to evaluate): increased reliability and equipment safety.

The highly-touted gas-turbine/pressurized boiler cycle will get its chance late in the decade when a coal-burning gas turbine is developed and completes sufficient running time to be adjudged practical.

There will be increased efforts to make use of heat now wasted down the steam plant's condenser sink by favorable alliances with those who can economically utilize this low-grade energy. A good possibility, already under early exploration, might be in the de-salting of sea and brackish water. However, this process is in competition with others, and the economics of any of them presently are tenuous. We believe the situation will be a great deal clearer later in the decade of the Sixties.

Boosted utilization of supercritical steam cycles seems inevitable, as experience with the few now on line and building is gained. This, plus subcritical applications of the once-through steam generator, will put continued stress on developing existing and new methods of water treating.

Problems with "heat pollution" of streams will cause greater use of cooling towers, in climates where they are applicable.

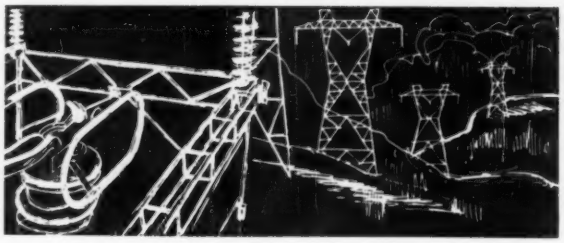
There will be substantial gains toward reduction of air and stream pollution from steam stations. Because of the political nature of the motivations forcing these advances, it is imprudent to hazard a guess as to direction or magnitude of the results. But we do think that experience and research will determine, by midway through the decade, the relative importance of the automobile, other industrial plants, and steam power stations in contributing to air pollutants. In itself, this will point the way to the relative emphasis to be given to efforts in these fields.

In the nuclear field, the controversy over the most practical route to economic atom power will still rage. But experience with first and second generations of several reactor types will begin to give an inkling of the most satisfactory approach. Yet, nuclear physics being in its fast-moving infancy, we may expect new reactor type challengers to appear periodically, begging for competitive evaluation.

Meanwhile, nuclear power will show at least marginal competition with conventional plants in several parts of the country, and there will be a flurry of ordering.

There will be sharply increased interest and expenditures on development of "exotic" direct conversion methods, including thermoelectric and thermionic generators, fuel cells, and magnetohydrodynamics. One or more of these will climb out of the laboratory curiosity stage, and proving efficiencies beyond those obtainable from conventional cycles, will undergo the first stages of practical, prototype operation and evaluation.

Transmission — Higher Voltages,



Research will help meet capacity increase and R/W squeeze, improve cable insulation

An explosive growth in transmission will be a hallmark of the Sixties. Inadequacies of circuit voltage and capacity inherited from the Fifties will be corrected and the sagging balance between generating capacity and transmission capability will be restored.

To achieve it, systems will burst traditional barriers of voltage, capacity, and technology to carry power in multi-million kilowatt blocks from major sources of generation into, through, and around major metropolitan areas and load centers.

As suitable new power plant sites close-in to load centers dwindle, the capacity of existing plants and of outlying new stations will multiply, forcing the length, capacity, and voltage of transmission circuits upward. The resulting problem will be toughest around old established power plant sites close to metropolitan load centers where industrial congestion makes transmission right-of-way scarce and thus high-priced.

The situation in the suburbs is scarcely better, where public reaction to overhead transmission has already put an element of urgency in the need for reliable high voltage transmission cable to thread more circuits through built-up residential areas.

The move to more and stronger interconnections will gain steadily through the decade.

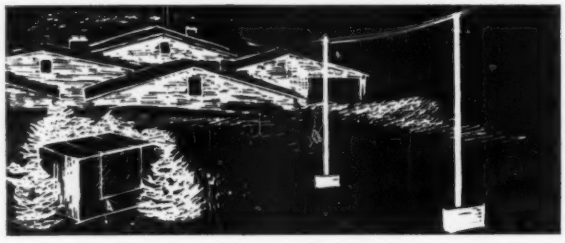
System studies will define the interrelationship between transmission costs and generation development patterns more closely, and the question of how to reduce the investment per kilowatt-mile will be heard repeatedly.

There will be a tremendous expansion at 345 kv. But 230 kv too will be used more extensively in areas where it is already well entrenched.

By 1966 the first fully-commercial 460-kv circuits will be in operation and there is a good chance that an even higher level will be in service on a small scale by the end of the decade.

Manufacturers will continue their development programs aimed at raising maximum voltages, but at a faster rate during the new decade. There will be a number of utility-manufacturer field test programs to prove experimental equipment and line designs. If

Distribution — Computer Will



Tool will permit reliability evaluation and help apply "system concept" to planning

Distribution, in the decade ahead, must be built with vision. It must apply new design concepts and new economic philosophies—many as yet unborn—to serve loads far in excess of those shown by historical statistics. Once built, it must serve these heavy loads until they grow beyond its utmost capability.

Distribution engineers of the Sixties will find the sheer magnitude of their job so staggering that their thinking will change drastically. For distribution expansion during the decade must add capacity at least equal to all that in service today. By 1969, distribution customers will be consuming over 700 billion kwhr, which exceeds sales to *all* customer categories this year. Distribution expenditures during the decade will exceed $20 billion.

Qualified engineers have claimed that established design concepts are adequate for all foreseeable demands. But the job ahead is so big, and so costly by today's methods, that distribution engineers will have to develop new methods. They will need unstinting management support to build up, train, and equip their forces. And they will need dogged determination to apply these forces to the utmost advantage.

The engineering computer is relatively new to distribution. Yet it gives distribution engineers for the first time a tool to analyze all the variables of an assignment which exceeds in complexity many better known and better paying businesses, department stores for example. This new tool will become, like its business counterpart, the most vital weapon against rising costs and inefficiency.

As for the overall electric system, the computer will

Advanced Tower Designs on Way

early experience with 345 kv is any guide, there will be more intense testing at any higher voltage levels before final line designs are set.

Strong emphasis will be placed on structure design. There is evidence already that some far-sighted line designers are going back to structural fundamentals in search of economically attractive methods of supporting conductors away from the ground, each other, and the structure. Their approach gives definite promise that the decade will spawn metal and wood tower designs only remotely resembling the traditional structures now marching across the landscape.

Even discounting these efforts, tower design experience gained in the Fifties has given data which will permit substantial cost reductions. Broken-wire assumptions, shown by actual service to be too conservative, can be revised to allow use of lighter weight and less costly structures. And there are yet other design assumptions which can be modified as new materials give greater latitude in putting strength into a structure most advantageously.

More utilities, during the decade, will swing to structures of aluminum alloy or high-strength low-alloy steel in combination with carbon steel or wood.

More engineers will design for positive control of clearances at the structure by "substituting" porcelain for steel, a growing practice for structures on confined rights-of-way.

As right-of-way costs for transportation of all commodities and passengers move inexorably upward, there will be renewed economic pressure on the part of all concerned to pool their problems and seek at least partial solution in the joint use of the very high-priced pathways.

Increasingly, this will mean electric transmission lines running down superhighway center strips and along railroads and pipelines. Acceptance will increase as economics casts its vote.

Joint use of rights-of-way will have a definite influence in two areas. You can expect special structure designs to accommodate the restricted widths and vertical clearances. And there will be added use of short links of underground transmission to prevent obstacles from barring a complete joint right-of-way plan.

Extra-high-voltage cable development already is getting much more attention than ever before. Attempts to "tailor" polymer compounds for specific insulation uses will pay off sometime during the decade with some intriguing new insulations in this area.

In transmission substations, the same economic pressures will be felt. High line loadings and heavy power concentrations in substations of the Sixties will put a premium on reliability and speed of protective devices. Use of new materials will result in cleaner-looking stations, with emphasis on reliability, low operating cost, and easier maintenance, despite more compact layouts forced by site restrictions.

Play Big Role in Distribution

make it possible for the "systems concept" to be applied to long- and short-range distribution planning. Mathematical models of loads and substation capacity will be used to portray the actual system, and to explore alternate expansion patterns. This will eliminate need to simplify calculations, and will give new power to explore combinations heretofore too time-consuming. The first steps toward this are underway.

The computer also will be used to make service reliability a predictable product of design parameters. It will permit analysis of performance data heretofore buried in reams of failure reports. Properly processed, these data will reveal interruption expectancies for distribution components and make it possible to meet the stringent reliability demands of the Sixties most economically.

Another of the many computer uses will be distribution transformer loss and impedance re-evaluation to determine optimums for future loads. Studies by utilities and manufacturers will grow, during the decade's early years, into new industry-wide standards.

In the quest for reliability, aerial cable will come into extensive use. It has long enjoyed acceptance for squeezing overhead distribution into congested routes where underground is the more costly alternative, or for avoiding tree trouble with open wire. Already major companies are moving in this direction, and we expect to see the trend accelerated, especially as insulations improve.

Underground will come into its own during the decade. Except for heavily congested areas, it has been opposed on cost. But diligent work by many utilities and manufacturers has been chopping away at the cost differential. By the end of the decade, direct buried cable in residential areas will be acceptable to most utilities, and manufacturers' efforts to supply reasonably-priced equipment for residential-class underground will be bearing fruit. And, while the practice of levying an added charge against the builder for underground service will be continued, this will become so nominal in many areas that its acceptance will be high. An important factor in lowering the cost differential will be increased customer usage, which has already boosted conventional distribution costs.

Extensive use of underground will provide another argument for higher service voltage, as higher voltage would give much greater secondary reach and permit larger, more economical distribution transformers. This

could justify higher primary voltages and perhaps eliminate distribution substations. But higher service voltage acceptance faces so many obstacles, it is unlikely the new decade will bring more than a few extensive trial installations.

As 12-kv distribution has virtually overwhelmed 4-kv for new work, there will be a trend toward even higher primary voltage levels. This has begun in certain areas with 23-kv subtransmission adapted to primary distribution use, often eliminating conventional distribution substations. This swing will be slow during the Sixties, but may reach acceptance comparable to 12 kv ten years ago.

By the very nature of distribution, standardization is a necessity. Industry standards for distribution substations will be battled out and ultimately accepted.

Out of this battle may come a new approach to substation design. For engineers, faced today with expensive metal-clad switchgear as the alternative where conventional open buses and separate circuit breakers

Research — Utilities Will

Basic work on materials to gain more attention; exotic fuel sources to get test run

Research and development for the electrical utility field is big business—and getting bigger.

According to McGraw-Hill Economics Dept, manufacturing research as a class now constitutes a sizeable proportion of gross national product. It has become a stabilizing influence—by virtue of its unflagging growth even during recessionary lulls—for the nation's overall economy.

Significantly, the only industry whose R&D expenditures exceed that of the electrical industry is the chemical. Electrical equipment manufacturers are spending 6% of gross in current basic and applied research. By the end of the Sixties, this proportion may well be up to 8 or 9%, due to the increasingly complex nature of the equipment.

Bulk of electrical industry R&D is carried by equipment manufacturers. But there is a trend for utilities to spend more direct money in this field. This is really nothing new, since there is a long list of test and development projects being carried on, usually as cooperative enterprises among utilities and often in partnership with manufacturers, at the present time.

Recently, this trend got a big boost with direct utility participation in nuclear and extra-high-voltage transmission projects. In the new decade, the trend will accelerate. We believe the result will be larger utility financial and manpower commitments to development and testing work, and a much smaller, but growing commitment to basic research as insurance of new ideas for the future.

An example of utility interest in basic work might lie in the field of fundamental materials development. Often it is difficult to interest materials suppliers to develop new materials specifically for electrical products because of the low tonnages involved. Utilities and equipment manufacturers will have to underwrite a

People — Their Views

The past five sections of this Survey of the Sixties have been concerned with physical matters, those which can be reduced to numbers and are susceptible to manipulation by sliderule and more sophisticated computer.

Yet any reasonably complete analysis of the decade to come must take into account perhaps a much stronger influence on the future: the human equation.

The utility industry is operated by human beings. And their free choice will be brought to bear on all the physical matters we've been discussing. Further, all the "publics" with which the utilities must interact—customers, regulatory commissions, investors, employees, politicians, and the press—all of these are also human. Their fundamental psychology, the way they view the utility image, are of vast, unmistakable importance in how the utilities will emerge from the new decade.

Thus in the following sections of this report, our main focus will be on those critical areas where the ideas, the attitudes, and the thoughts of man play a direct and definitive role in our industry's future.

These are the delicate areas of regulation, administered usually by politically appointed commissioners;

cannot be used, have already turned to house-like structures to hide substations in critical sites. Site restrictions during the next decade will not relax the pressure for such installations. Tomorrow's engineers would find growing use for new equipment built for wall mounting in these aesthetic enclosures.

There will be a trend, halting at first, toward utility ownership of service entrance equipment, thereby assuring capacity for any major appliance the customer wishes.

Selective sample testing will win acceptance as standard procedure for maintaining meter accuracy. As additional experience with this statistical method is obtained, commission and utility opposition will melt.

New, more reliable, tougher insulations will become available, enhancing use of aerial and direct-buried cable at higher voltages. But these new insulations will have to undergo a number of years of service before universal acceptance, so don't wait for a revolution here during the Sixties.

Spend More to Beat Back Barriers

portion of the needed effort, frequently through university or independent labs.

Output from equipment manufacturers' labs can be expected to increase at a pyramiding rate, as their basic work begins to show results. We've already seen startling developments in the nuclear and solid-state physics areas, with nuclear power, semi-conductor rectifiers, transistors, and some promising direct-conversion power devices as prime examples. With solid foundations already laid in these two areas alone, you can bank on exciting possibilities in the Sixties.

Another area under heavy R&D attack is in "tailoring" molecules of metals, plastics and ceramics to do a specific job. This could have a strong influence on high-temperature materials performance and electrical insulation over the new decade.

Direct conversion of chemical or thermal energy to electrical without use of the inefficient turbine cycle has been a dream, but a number of approaches have been tried and found of potential worth recently: thermoelectric, thermionic, magnetohydrodynamic and fuel cell converters have received much attention, often as a by-product of national defense activities.

Increasingly, though, the more promising will be pursued directly by the electrical industry. By decade's end, we confidently expect one of these approaches to emerge from the lab and take its place in test-prototype form on a utility system, probably used as a topping unit on a conventional steam cycle. And we're equally sure that as-yet unthought of methods will be revealed.

It is evident that work on dc-to-ac inversion will be stepped up sharply. There are two incentives: reduction in terminal costs for the always-on-the-horizon dc transmission schemes; and need for practical, power-sized inverters for getting energy off a direct-conversion source and into the electrical system.

You can look for fundamental work toward radically-different concepts of power switching devices. The demands of the electric power systems of the Seventies will promote effort starting in the Sixties.

There will, of course, be continued work toward thermonuclear power. But we look for the bulk of this R&D to be underwritten by the government while practical results are so far away.

One bane of utility existence is poor load factor coupled with the inherent quality of electricity that it must be consumed the instant generated. No practical large-scale electricity storage device is available. But those who use the term "can't be done" are foolhardy. The economic incentive is there, and it may be that the Sixties will see conceptual gleams of new inspiration in researchers' eyes.

Will Play Definitive Role

politics, which is dependent upon the knowledge and the views of voters; and utility personnel. In these areas the attitudes and views of people are uppermost. We most fervently hope there will be no novel or effective way of controlling or manipulating these views or attitudes, for we believe the basis of our system of government and way of life is dependent upon freedom from such control.

Except possibly for the financing of new plant, these are the most controversial and the most neglected areas in the entire spectrum of the electric utility business. These are the areas that demand the attention of every top executive and the understanding of every electric utility employee.

But because the human equation has many unknowns, any presumption to chart the future in these areas is not only hazardous, but downright foolhardy. Nevertheless, any attempt to disregard or pass lightly over these areas would be to indulge in intolerable escapism.

Recognizing the dilemma, we forge ahead, tongue more firmly in cheek, and taking care not to damage the bridges behind us.

Survey of the '60's

Financial

Utilities Will

Money rates will probably continue on high side for years; more equity financing seen

The electric utility industry enters the next decade with a record expenditure for plant and equipment to take care of the needs of our growing population which necessitates greater industrial production. Money rates will continue high for the early part of the 1960's. Thereafter some easing will take place. Total electric revenues and net income of utility companies will register record highs.

In the next ten years the entire electric utility industry will spend approximately $67 billion for new construction of plant and equipment. This is based on today's value of the dollar.

Of the $67 billion to be expended, private electric utility companies will spend some $53 billion. This will be about $10 billion more than the gross electric plant account of the Class A and B utilities will show at the end of 1959.

To take care of this large construction program, electric companies will be able to generate around 40% of the needed funds from internal sources, which would include depreciation, retained earnings, and funds arising from the deferral of liberalized tax depreciation.

Of the $53 billion to be spent for new construction, electric companies will have to raise about $32 billion in the money market in the form of bonds, debentures, preferred and common stocks. A total of around $10 billion will be in common equity, about $4 billion in preferred stock and the balance in bonds and debentures.

Money rates are at the highest point for nearly 30 years and will remain on the high side for some time.

The reasons for this are complex, but basically it boils down to this: The demand for money now exceeds the supply, and it looks like this will continue for several years.

The Cold War, foreign aid, and welfare spending at

Regulation

More Recognition

Other regulatory and tax action needed to attract capital and protect the shareholder

The regulatory climate will become real hot before the next decade comes to a close.

For rate-making purposes, some electric utility managements will be fighting for a "fair value" rate base on their properties. Others will say that "original cost" should be used with a higher rate of return than the traditional 6%. Economic depreciation, which makes the enterprise whole, irrespective of the ultimate disposition of funds produced, will come into the spotlight as the decade wears on.

These are some of the regulatory problems the industry will face while the utilities add property at a record rate. Property accounts will quadruple in some companies in the next ten years. The industry as a whole will at least double in this time.

With these large expenditures on the way, and regardless of the method used to get an adequate return, managements and regulatory commissions will work together to see that there will be adequate earnings to take care of this program. These earnings will be needed so that the electric utility industry will continue to be a sound and financially prosperous member of the American free enterprise economy.

Commissions will be giving more recognition to the fact that the industry competes in the free market for the investor's dollar. We know that industries not subject to regulation and whose pricing structure is based essentially on the "fair value" concept, have earnings and security prices which reflect these favorable conditions.

Some regulatory commissions will be looking at other ways to see how the industry can get an adequate return. One way, which the commissions will no doubt study, will be to apply the standards of earnings of

Spend $67 Billion for New Plant

home seem to guarantee that the Treasury will be borrowing heavily. Corporate borrowings are on the rise, and home mortgages will rise even faster. At the same time, the fight against inflation will continue to hold a rein on credit, which will also tend to buoy up money rates.

However, there is a strong possibility that as amounts available from pension funds, institutional investments, and other personal savings increase, money costs will decline later in the decade.

Since debt costs will remain high for some time, you will see more electric companies finance their "new money" requirements for construction through the sale of common stock rather than debt in the first part of the next decade.

Not only will this give the electric utility industry substantial leeway in the future to issue debt when this type of security becomes more attractive but additionally the industry must consider the possibility of reducing its factors of risk which a heavy debt structure entails.

The next ten years will be years of accelerating technological progress with the concommittant possibility of increased obsolescence of plant and equipment taking place.

Another factor will be the adequacy of earnings which will control not only the price of the "new money" but also the amount of additional re-investment which electric utility companies will obtain. Such re-investment will improve the position of the existing security holders and make material savings in the cost of the new financing.

Electric utility companies will show a steady growth in income during the next decade. By 1969, total electric revenues will hit at least $20 billion.

Net income (the amount available for all dividends) will likewise show a terrific increase. It will amount to around $3 billion a year by the end of the next decade.

Dividends will also show a healthy gain and will total about $2.5 billion. Common stock dividends will lead the way as more stock is sold to help finance the large expenditures of plant and equipment in a growth industry.

The amount to be transferred to surplus and held in the business will increase to around $500 million by 1969.

One essential thing to recognize is that whatever the range of capital cost will be, the electric utility industry's earnings should be such as to not only attract new investors but also to protect the securities of those who have committed their funds to the enterprise at an earlier date with dollars of higher purchasing power.

for "Fair Value" to Be Sought

comparable industries in order to give the electric utility companies adequate earnings.

Even more important than adequate earnings based on current value is the need for recovering property costs used in public service in terms of the same current value. Any change in this direction will be assisted by changes of the federal income tax laws for tax depreciation purposes.

Current cost depreciation is especially important in a period of rapid technological change, where major trends of obsolescense may develop. A good example is atomic power. The industry in the decade ahead should be providing for these technological advances.

A step in this direction has already been taken by a recent order of the Michigan Public Service Commission on accounting for the proposed atomic power plant of Consumers Power Co at Big Rock Point, Mich.

Here the cost of the plant exceeding the cost of a comparable steam plant may be amortized as an "above-the-line" expense over a period of about 13 years, instead of a longer period traditionally accorded to steam plants. This practice will no doubt be continued in the 1960's by other regulatory commissions.

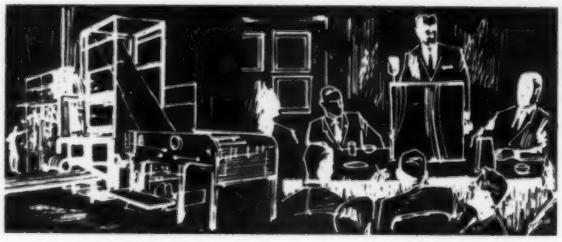
As far as accelerated depreciation is concerned, more regulatory commissions will recognize that customers, stockholders and the industry will benefit through the normalization of these tax deferrals. This will be due to the fact that substantial savings will be made in raising capital which will affect the customer and also improve the equity position of the owners of the property.

Commissions will come to recognize more and more the magnitude of the utilities' problems caused by inflation. As the decade progresses, utilities will find commissioners less inclined to line up with consumers in rate proceedings, provided utilities can show clear proof of the need for higher rates.

The Sixties will also see the utilities themselves adopt a more enlightened approach to regulation. As they realize that commissions draw their power from the people, utilities will exert more effort in explaining the issues of a rate case before the public. They will also maintain closer relationships with regulators than they do now.

In the next ten years, regulatory commissions will have more qualified people becoming commissioners and members of the staff. The reason is that the state legislators will recognize that these public service servants should get higher pay and fringe benefits commensurate with their talents and responsibilities.

Public Relations In Complex Age



More coordinated approach to PR problems will be taken by pioneers; more surveys used

A more comprehensive approach to public relations is likely to gain adherents in the Sixties. Some pioneering utilities are already working toward a coordinated program aimed at each of the varied publics with which a utility must deal. The objective of such an approach is to create a coherent and consistent image of the utility—an image that will appeal to the employees, the customers, the shareholders, the politicians, and the regulators.

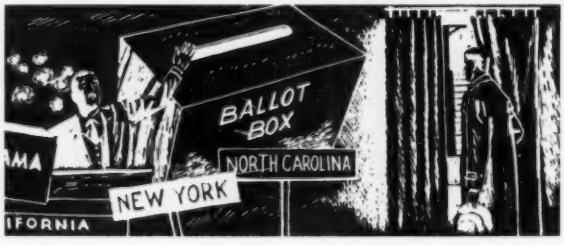
This objective could be achieved by a single, integrated PR policy, which considers the effect of each company decision on all these "publics." In philosophy, such a policy would parallel closely the "systems concept" which will be applied to physical systems and components, as outlined on previous pages.

The PR department will have to move into areas left vacant by the fewer contacts which utility people will have with the public in a decade when merchandising wanes and bill collecting is all handled by machines.

A PR-oriented work force will augment advertising and publicity copy that stresses service value and reliability. This effort and other PR programs, however are not going to have much impact on the average customer's understanding of a company's role in the community or the industry's role in the U. S.

It would take a crash program to impress even a third of the industry's customers with, say, the story on earnings as it relates to plant investment or, for another example, that regulation provides not guaranteed profits but, rather, fair play for the public and power companies. From the evidence on hand, such a crash program will not evolve in the next decade. The recent admonitions by industry leaders on the need

Politics Government May



No reverse seen for trend toward more centralized government, but tactics will change

From a political viewpoint, what happens to the American electrical utility industry in the coming decade will be nothing less than what happens to America itself.

To gain some idea of what the Sixties hold, it is first necessary to look at those broad factors which will help shape the general political environment.

To begin, there has been a general shift to the Left in America—indeed, the world—probably beginning even before World War I. This shift has received setbacks, and will receive more. Yet it would be myopic to bank on an about-face in the long-term trend.

Secondly, there is a general awareness across the political spectrum that government can be used to satisfy an increasing number of social and economic needs, especially where no other agent is willing to satisfy them. Here we have seen the Republicans accepting almost all of the so-called "welfare state" programs of previous Democratic administrations.

Thirdly, so long as the world is polarized with the free nations at one pole and the communists at the other, the concept will prevail of mustering our military, economic and social resources in a highly centralized fashion.

So much for the general. To project any specific political considerations for an entire decade would be presumptuous, if not downright foolhardy. But it is possible to put the probable events of the next few years into sharper focus.

Federal encroachment into the power business can take many forms: hydro, conventional steam, or nuclear generation; transmission networks, regional and national; varied degrees of regulation superimposed on state- and local-level bodies; and financial support for co-operatives through subsidized loans.

We've seen public power advocates turn their emphasis to steam power only where the federal government assumed utility responsibility (TVA); but we've

Industry PR to Maintain Status Quo

for improved, expanded PR will, however, be heeded, even if in the shotgun style of the past.

This will call for long-range PR planning as opposed the extinguishing of fires as they occur. One advantage here will stem from the more frequent appearance on organization charts of the post "Vice President in charge of Public Relations." With a more authoritative voice on decisions affecting the public, this VP will steer his company clear of blunders that now cause embarrassment and ill will. He also will refine methods of communicating with the utility's varied publics.

More emphasis will be placed on the results of local and national surveys, increasing in number and scope. The findings on public attitudes and knowledge on, and employee-stockholder awareness of, the industry's problems and accomplishments will let the PR man sell positive programs to a boss.

In addition to the help from surveys, the power company PR chief will profit from another quarter: the hiring of staff members with experience, or the capacity to learn journalism, economics and engineering, plus the ability to get along with people. As a further aid to revitalizing utility PR, more companies will turn to agencies for counsel on specialized and general campaigns.

Partly as a result of these developments, power companies will focus more attention on the youth of the nation. Besides atomic power shows and tours, 4-H and Junior Achievement, and movies, PR departments will increase the scope of school presentations which dramatize applications of electricity and challenges of getting it to the customers. Libraries will begin to receive new and updated books on these topics. And summer sessions for teachers will provide more opportunities for them to see and ask about the utility business.

These and other PR developments will evolve as top management backs up public relations lip service with more monetary and more moral support in the next decade. The needed support, however, will produce programs that neither alter today's image of the industry, nor eliminate today's difficulties. They will serve, instead, to maintain at least a status quo in a period when trends in politics, regulation, finance and labor add to the complexity of present PR problems.

The power companies may step toward attaining a more favorable national image by sublimating some local problems to united expression. Yet this means surrendering some company sovereignty for the majority good. We hope they will do it.

Push for More Interconnections

seen their demands for federal atomic generation increase as the prospects for continuing hydro dimmed.

We expect the TVA situation will be relatively stable. Attempts will be made to legislate a broadening of the Authority service area, but these will be of limited scope. TVA, will, of course, continue to build steam as required by internal expansion of its prescribed service area.

In nuclear generation, we believe that if private companies continue a somewhat higher level of activity than presently, the only public power A-plants will be a few prototype stations of types which investor-owned companies do not believe worth pursuing. The danger, of course, is that their judgment may be faulty, and that a particular successful type will fall to public power as a proprietary development.

With success of TVA in becoming a self-bonding agency with implied authority to build any generation required to sustain expansion, there will be tremendous pressure from the public-power minded Northwest to turn the present BPA-Engineers Corps-Reclamation Bureau complex into an integrated self-sufficient Authority with the same general broad powers.

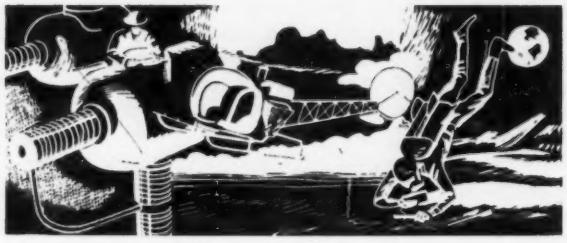
The first of these efforts will be seen in the next Congress. With so much hinging on near-term elections, we hesitate to venture a prediction here. But there are cold facts: the Northwest will be running out of hydro by the decade's end, and thermal generation will be required. Unless the private companies assume this presently-uneconomic burden with proper timing, federal encroachment will be perpetuated.

With waning prospects in generation, some politicians will try to push the federal government into undertaking inter-regional, or even national, power grids as gigantic overlays for existing pools and interconnections. While engineering logic would preclude such attempts at economic planning, this situation cannot be brushed off. We believe the private companies, galvanized to some extent by the threat, will intensify their well-based interconnection programs in strong attempt to stave off federal interference in this area.

Something like 96% of the nation's farms are electrified, so rural co-op leaders look for new fields to conquer. We look for strong co-op pressure to serve the burgeoning urban sprawl around our cities. It may be that an increase in the 2% REA interest rate will be traded politically for relaxation of some present co-op statutory restrictions, such as the 1,500 population limit.

The other area of public power influence is in municipal ownership. There is no strong trend here at present, and there will be none, providing private management is alert to the hazard, and keeps its house in order.

Personnel For Bigger Jobs: Broader Training Will Be Needed



Specially trained administrators will gain: Step-up in internal training is foreseen

Finally, in this Survey of the Sixties, we turn to the people who will operate these properties. The cliche "last but not least" was never so applicable.

For here is the flesh, blood and grey matter which will guide the destiny of the enterprise through this sometimes sparkling, sometimes stormy, but never dull period.

In the past, it has been frequently true that one or two men in key executive positions had a tendency to over-emphasize that segment of the utility's activities which they knew best. Often, and not illogically, their very presence in the key posts reflected a particularly vital need of the utility at the time of their selection.

Thus, if a system had excess capacity, a sales officer likely would become chief executive; if it was underbuilt and in need of repair, an engineer; if involved in rate problems, possibly an accountant or lawyer.

But more important, the chief executive occasionally had little training and experience in what now became his new specialty: broad, balanced management and administration.

Like other businesses, the utilities have seen a countering trend toward development of a strain of people trained especially for the broad responsibilities of management. But utilities may be unique in one respect: the industry itself is a special breed of cat among U.S. businesses, due mostly to its regulated earnings. Hence, the tendency has been, and will be, to promote from within the industry and usually from within the utility.

We've noted several times through this Survey a trend toward acceptance of a "systems concept," certainly not new, but gaining new definition and stature. In this, a "system" is treated as a whole entity. Each component is regarded as but a cog in a machine, with its plans and performance related always back to those for the entire enterprise.

Nowhere is it more important this concept be realized—and stated—than in relation to the entire utility. For the best operation, long-term, will be achieved by the utility whose executives plan and decide on this basis.

We are confident this concept, though often not expressed in this manner, will gain continually increasing acceptance by incumbent management teams and their successors in the decade to come.

Engineering, marketing, operations, finance, rates, public relations (for all the "publics"), and all other divisions of the business will tend to be emphasized only so as to give the best overall balance in the comprehensive, coherent utility program.

To ensure this, there will be added emphasis on management training: in internal, formalized programs, and in intensified reliance on utility management summer school sessions such as are held at several universities. Management selection will be based more and more on breadth and scope of interest and ability.

One of the main problems confronting the industry long has been the attraction of new blood. This has received considerable attention in the engineering area, but applies across the board. Without question, the main impediment is the poor industry image held by a majority of prospective employees. The utility widely is regarded as conservative, stuffy, slow-moving, and without challenge.

In the Sixties, there will be renewed efforts by the utilities to counteract this image. Much emphasis will be placed on reaching the more sophisticated. The job may become easier as some of the changes awaiting the systems over the decade come to be.

There will be more effort to instill educators with favorable attitudes toward utility endeavour. There will be more summer work for students, with a greater emphasis on less menial and more representative tasks during the period. There will be greater use of personal contacts and media advertising to laud the opportunities which really exist, and the way training programs can set the stage for advancement.

As this 16-page Survey of the Sixties shows, the men who choose to devote their careers to electric utilities in the years ahead are in for challenging and exciting times.

To make this staff report available to job candidates and recruits for utility positions, reprints can be made.

For information prices write:

Reprints, Electrical World
330 W. 42nd St.
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GENERAL ELECTRIC ANNOUNCES . . .

New Custom '8000'* Motors

PROJECT '8000' . . . a major General Electric program of research, redesign, advanced manufacturing and improved customer service on A-c motors 150 to 6000-hp.

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CUSTOM DESIGNED . . . New General Electric Custom '8000' motors are built specifically to meet your requirements. Selecting from specially designed enclosures, advanced insulation systems, custom-designed end shield and bearing constructions, and more than 15 custom-designed accessories—plus a countless number of electrical designs—General Electric engineers will create a motor to meet exacting needs, provide initial and continuing economy, and give long, reliable service. Turn page for features of new Custom '8000' motors.

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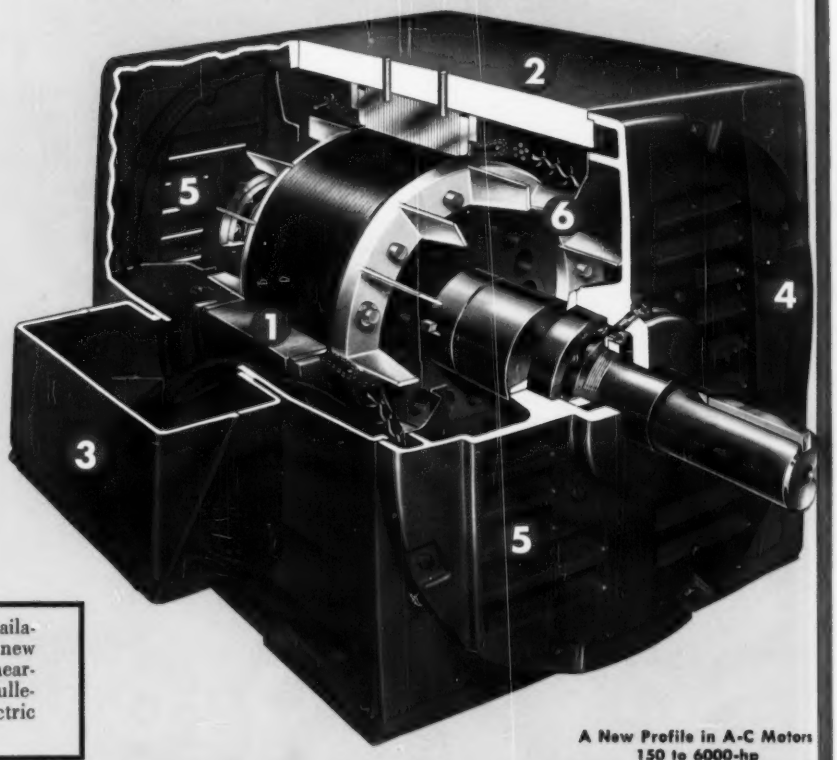
another G-E PROJECT '8000' development

NEW Custom '8000'* Motors Give Greater Reliability Require Less Maintenance

1. **LONGER INSULATION LIFE**—Pre-wound core allows closer quality control and gives longer insulation life through improved varnish impregnation or silicone rubber encapsulation.
2. **BETTER CONSTRUCTION**—Cast iron frame withstands 20G simulated transportation shock tests; resists corrosion.
3. **FASTER INSTALLATION**—Conduit box has up to 3 times volume of ordinary boxes; lifting lugs, cast to frame, hold up to 12 times motor weight.
4. **EASIER MAINTENANCE**—Flat end shields are more adaptable to addition of accessories or modifications; are lighter—easily handled by one or two men.
5. **BETTER COOLING**—Double-end ventilation, new duct design and louvred air openings provide more efficient air distribution through motor, reduce hot spots.
6. **LOWER NOISE LEVEL**—Sound power has been cut up to 50% by redesigning frame sections, rotor fans, air deflectors and intakes.



A New Profile in A-C Motors
150 to 6000-hp

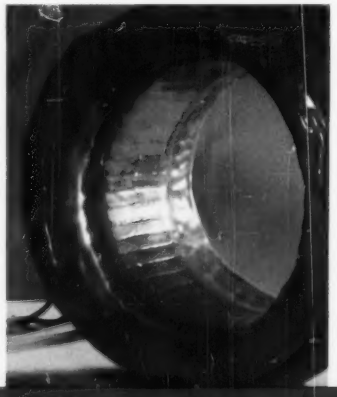
FOR COMPLETE INFORMATION and availability dates about General Electric's new Custom '8000' motor line, contact your nearby Apparatus Sales Office, or write for bulletin GEA-6865, Section 884-2, General Electric Co., Schenectady, N. Y.

NEW *Polyseal* SILICONE RUBBER INSULATION SYSTEM IS AVAILABLE ON CUSTOM '8000' MOTORS

Silicone rubber used in Polyseal insulation systems is a product of General Electric's Silicone Products Dept., Waterford, N. Y. . . . a leader in research, development, and manufacture of silicone materials. Supported silicone tape is a development of General Electric's Insulating Materials Dept., Schenectady, N. Y. Combining silicone rubber with dacron-glass supporting materials is a major engineering advancement, giving this material both the mechanical and dielectric strength required for use as a motor insulation. Polyseal insulation systems are available *only* on General Electric motors. Medium AC Motor & Generator Dept.

FORM-WOUND MOTORS

Polyseal supported silicone rubber insulation system provides greater mechanical, thermal, voltage and environmental endurance than unsupported silicone rubber. Glass fabric materials are imbedded in each layer of silicone tape, which, after coil wrapping is vulcanized under heat and pressure to seal the system against moisture and contaminants. General Electric form-wound open motors with Polyseal insulation system can be used in some severe atmospheres formerly reserved for totally-enclosed motors.



RANDOM-WOUND MOTORS

Polyseal silicone insulation system offers greater flexibility and better heat transfer than existing encapsulations . . . it operates effectively from —90C to 200C and will not crack under excess thermal cycling or severe moisture. After receiving G.E.'s standard random-wound insulation treatments, Polyseal insulation is applied to stator and end turns, completely sealing windings with a thin, waterproof, inert covering which protects against extreme moisture, most chemical fumes, dust and corrosion.

*Trademark of General Electric Co.

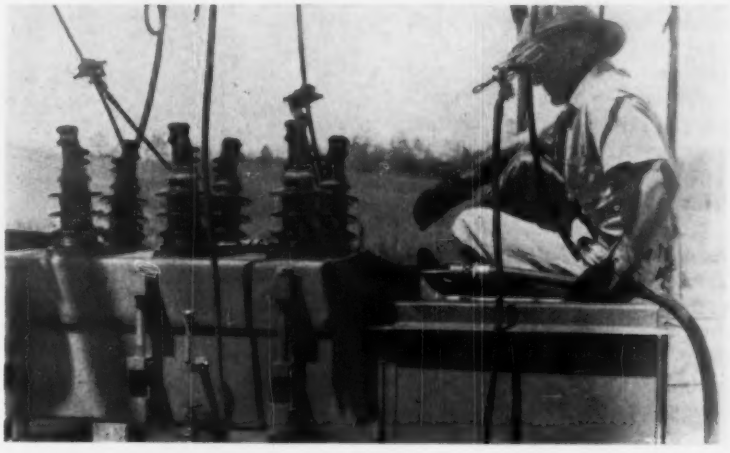
Progress Is Our Most Important Product

GENERAL ELECTRIC

Pressurized Oil Cuts OCB Cleaning Time

FRANK NYE, Substation Foreman, Newark, Ohio

ROBERT HOUSEHOLDER, Substation Foreman, Southern Division, Ohio Power Co, Lancaster, Ohio



Overhaul time for some types of oil circuit breakers can be cut 50% through the use of a method of removing carbon deposits with pressurized oil. This method is particularly applicable to those breakers whose entrance bushings have to be removed before carbon and other deposits may be hand-cleaned from the operating mechanism and barriers in the section above the oil tanks. As used by Ohio Power Co, the pressurized method saves 10-12 man-hr and allows two OCB's to be cleaned by one crew in one day.

Formerly, entrance bushings had to be removed before cleaning could be done. When these bushings are removed, the gaskets are disturbed and the contacts are thrown out of adjustment. To avoid removing the bushings, a method was devised for introducing clean oil at 55 psi into the breaker.

A gear pump supplies oil to a 43-in. length of ¼-in. pipe which has a 90-deg street ell on the end to serve as a nozzle. A good grade of unpainted black pipe should be used. Galvanizing may flake from a galvanized pipe and contaminate the breaker. Flexible oil hose connects the pump to the nozzle pipe.

The pipe is inserted into the breaker through the oil-fill hole. For flexible movement of the pipe to all parts of the interior, it is necessary to remove both the oil-fill pipe and the cap. By moving and rotating the nozzle the operator can wash all the carbon and other deposits from the inside of the breaker with a cyclone-spray of oil.

If desired, the oil pump can be operated in a barrel that serves as a return tank and settling basin for the dirty oil. It is recommended that some means of visual inspection such as a mirror, be used to assure that a good job of removing carbon has been done.

Adapt 3-Wire Meters for 2-Wire Service

Elimination of the possibility of a loose pigtail inside the meter socket and simplification of the job of removing a meter are two features of a procedure for adapting 3-wire 240-v meters for 120-v 2-wire service. The procedure, worked out by Public Service Electric & Gas Co, covers type DS meters made by Westinghouse Electric Corp.

This new procedure is an alternative approach to the prevailing, acceptable practice of wiring the socket to put the meter current coils in series, and to run a pigtail between the socket's ground terminal and the meter disconnect link which is left open. The new procedure is as follows:

1. Use a five-terminal socket with the fifth terminal in the horizontal position on the left. (A type-S socket may be converted simply by installing a 3-jaw terminal block assembly on the left side.) The socket is wired so as to put the meter's current coils in series.

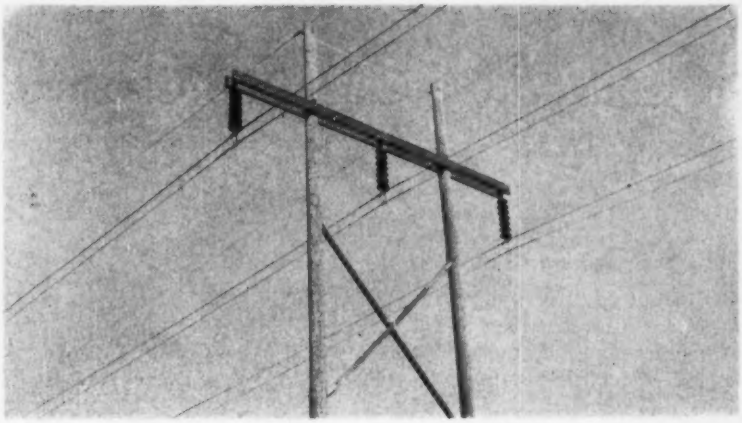
2. Wire a jumper in the socket between the socket ground terminal and the fifth terminal.

3. Install a 120-v conversion kit available from the meter manufacturer. This kit includes a terminal bracket and one $\frac{5}{16}$-in. type-F self-tapping screw. One end of the terminal bracket is clamped by the disconnect link screw and positively holds the link in the open position. The other end of the terminal bracket is clamped to the meter base by the self-tapping screw. Meter bases which include the hole required for this self-tapping screw are used on Westinghouse meters bearing serial numbers above 34,800,000.

(More Methods on page 88)

Re-Sag Old Conductor Before Bundling

GLENN CHASE, Construction Supt, Southwestern Public Service Co, Amarillo, Texas



The secret of success in bundling a new transmission conductor with an old one is to untie and re-sag the old conductor first. Then, the new line is pre-stressed so that sagging of the two lines is uniform. For best results, weather conditions should be good and wind velocity should not exceed 15 mph.

Recently, the 115-kv line between Denver City Plant and Terry County interchange on the Southwestern Public Service system was bundled vertically, adding 80% to capacity. Both old and new lines are 4/0 ACSR. Average span length is 550 ft. Spacing between two conductors in the same phase is 10 in. Reel lengths of the new conductor were pre-stressed using a dynamometer, then spliced, sagged and clipped in.

The string-sagging method was used for checking (a string attached to the line is jerked and the time required for the third "jump" is determined with a stop watch). The time (about 40 sec) for this period squared and multiplied by 0.1118 gives the sag in feet. System construction men finished the 33-mile section in 40 working days with about 12 men on the job, an excellent record because much of the line is through sandy and rough terrain.

Ten Steps for Air Switch Overhaul

H. H. MARSH, General Supt of Substations & Shops, Duquesne Light Co, Pittsburgh, Pa.

Better control over quality during overhaul and reduction of scheduled outage time are two features of Duquesne Light Co's practice of shop overhaul of air break switches. This program covers more than 1,200 switches having voltage ratings of 23 kv, 69 kv and 138 kv, with most switches being located outdoors.

Gang or group-operated air-break and load-break switches of various makes, types, and ratings have been operating on the company's transmission and distribution systems for almost 40 years. Because these switches are expensive to maintain, the company has found it most practical to rebuild or modernize them in the shop so that they may be put on an "as-required" maintenance basis.

While some switches are on poles on the overhead line system, most are found in substations and power stations. A very large number are outdoors, more than 1,200 in substations. Some rebuilding or modernization of switches is done in the field. This work usually consists of replacement of current-carrying parts only, using the existing bases, bearings, insulators, and operating pipe and crank assemblies.

Where regular field maintenance is not enough to prevent deterioration, it has been found to be most practical to give the switch a complete overhaul in in the shop. Shop rebuilding of switches includes this work:

1. Regalvanize or sand blast and paint the channel base or replace it (new base usually of aluminum).

2. Recondition or replace channel bearings.

3. Clean insulators or replace them with NEMA standard insulators.

4. Rebuild the pole unit operating mechanisms.

5. Replace worn or frayed flexible shunts.

6. Silver plate contact-making end of the switch blade.

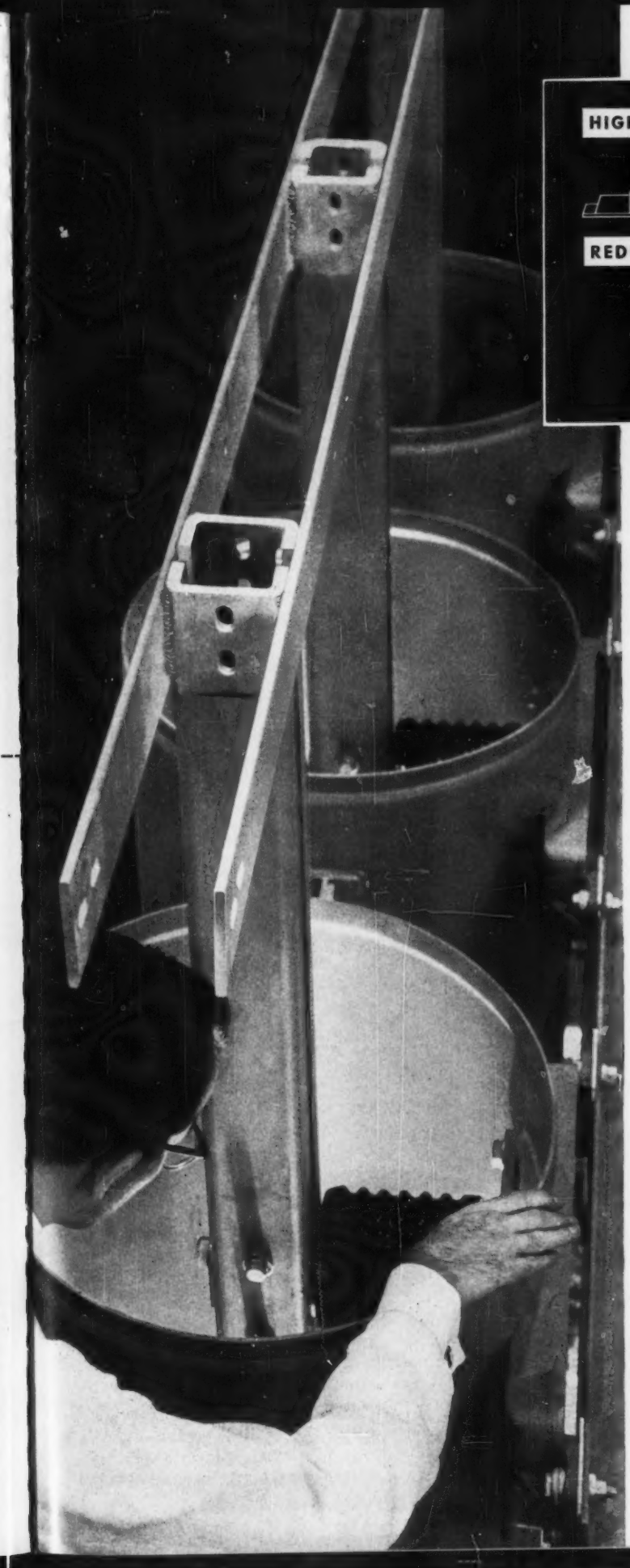
7. Replace obsolete jaw contacts with new contacts (usually multi-finger, hooded type preferred).

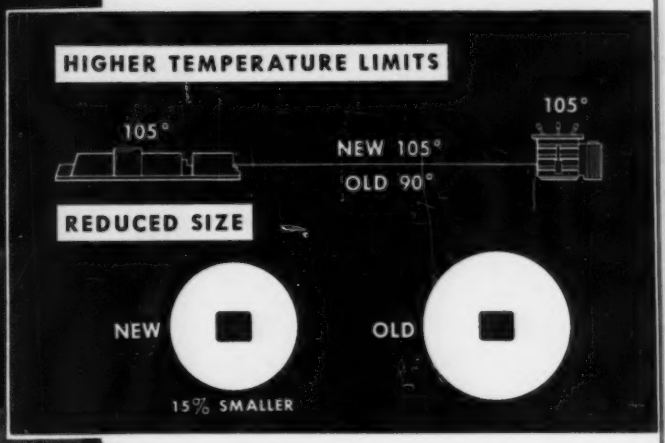
8. Install new arcing horns, sometimes of stainless steel, to obtain improved arc-breaking characteristics.

9. Provide the switch with terminals meeting company standards.

10. Place the switch contacts, toggle joints, levers, etc, in proper adjustment with respect to the pole-unit stops for a minimum of field adjustment following reinstallation

To overhaul switches in this manner it is necessary that a spare switch of the same type be available. This spare switch replaces the switch to be shop-rebuilt, which following its rebuilding becomes the spare for similar replacements.





WITH GENERAL ELECTRIC ISOLATED PHASE BUS YOU GET . . .

Higher Temperature Limits— at Reduced Cost

New and tested metallurgical improvements combined with advanced welding techniques now permit the introduction of a 105°C isolated phase bus specifically designed to match turbine-generator and transformer hot-spot operating temperatures.

Upping permissible temperature limits by 15°C reduces bus diameter as much as 15 percent—with a corresponding decrease in cost.

Improved General Electric 105°C bus retains all the original advantages that have always made metal-enclosed duct a superior method of providing conductor support for bus runs. Single-insulator design, reduced maintenance, ability to withstand higher forces, and elimination of condensate problems are basic product benefits.

This new design improvement, a result of intensive fault and heat run testing, is still another contribution from General Electric to help electric utilities reduce their investment per kilowatt hour of operation. For more information, contact your nearest G-E Apparatus Sales Office, or write to Section 496-9, General Electric Company, Schenectady 5, N. Y., for Bulletin GEA-6874.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Find Line Charging Values

W. J. PITCHER, Planning Engineer, System Planning Engineering Dept, Dayton Power & Light Co, Dayton, Ohio.

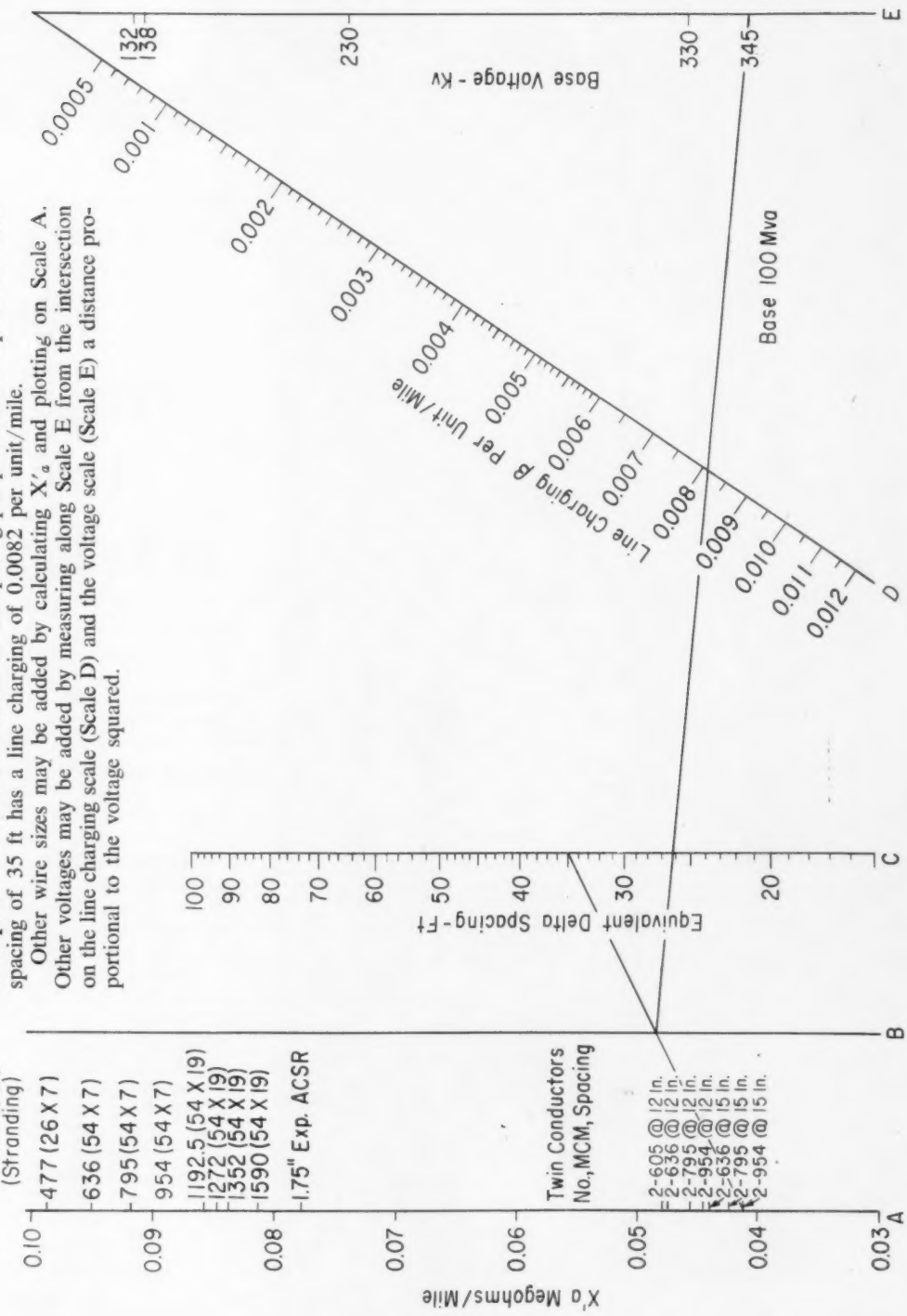
1. Draw straight line from proper phase wire or twin phase wires (Scale A) to equivalent delta spacing (Scale C).

2. Draw straight line from where this first line crosses line B to base voltage (Scale E).

3. Read per unit β on slanting Scale D.

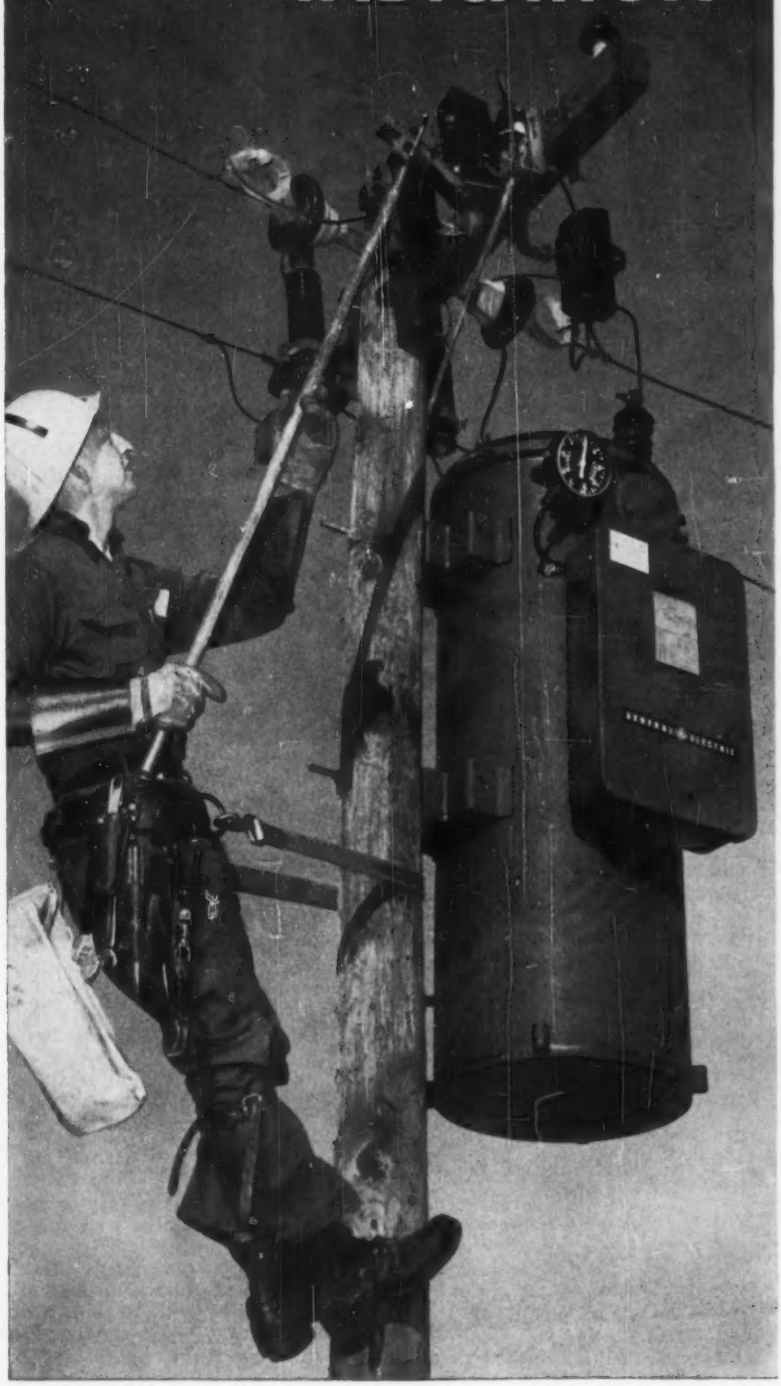
Example: 2-954 MCM ACSR at 15 in. spacing per phase at an equivalent delta spacing of 35 ft has a line charging of 0.0082 per unit/mile.

Other wire sizes may be added by calculating X'_a and plotting on Scale A. Other voltages may be added by measuring along Scale E from the intersection on the line charging scale (Scale D) and the voltage scale (Scale E) a distance proportional to the voltage squared.



ANOTHER STEP AHEAD IN VOLTAGE REGULATION

POSITIVE NEUTRAL INDICATION



NEW

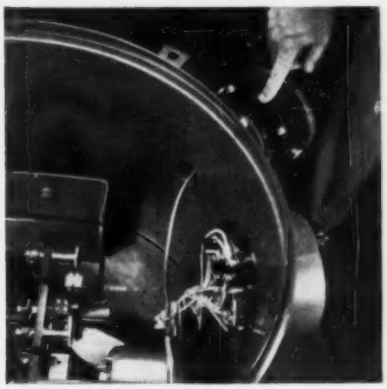
Mark-II position indicator for G-E voltage regulators protects lineman and equipment

Exclusive Mark-II Load Bonus position indicator and indicator drive system for General Electric single-phase step voltage regulators provide positive indication of tap-switch position. This gives more assurance against fear of injury to personnel or equipment when bypassing regulators on hot lines.

Linemen are aware that if a regulator is bypassed with the tap-switch off neutral position, the dead short created across part of the series winding can destroy equipment and seriously endanger the lineman.

It is important that operating personnel *know* that regulators are in the neutral position before bypassing. The new General Electric Mark-II Load Bonus position indicator provides this assurance.

New Mark-II position indicator system—standard on all G-E ML-32 regulators at no price premium—is an example of General Electric's continuing leadership in voltage regulators. This is another reason why G-E regulators cost less on the line. Ask your regulator representative for more information. General Electric Company, Schenectady 5, New York. 423-43



NEW MARK-II INDICATOR drive system eliminates possibility of indication error. Unique locking coupling and gear-driven indicator assure positive alignment of indicator hand and tap-switch position.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Procurement & Products

PRICES ▶ **A few signs pointing toward price stability** for heavy electrical equipment were apparent this week. Some manufacturers are withdrawing previously quoted prices. A few purchasing agents note some signs of price firming. But probably more important in the long run is outlook for an upswing in orders for areas of the business in which prices have been notably soft.

What were the reasons behind the price softness over the past months? Utility purchasing men interviewed recently came up with a variety of explanations. Some couldn't see any sense to the low prices, or said there was "no practical meaning" to them. Others charged it up to the tight competitive situation among manufacturers. Still others thought foreign competition had played a role in lowering prices on heavy equipment, and one saw it as a means of building up backlog for recently automated plants.

A manufacturing spokesman pooh-poohed the idea of foreign competition as a reason for the price situation. He blamed over-expansion of manufacturing facilities and a lull in utility buying.

ALUMINUM ▶ **Prices on basic aluminum were moving up last week,** following the lead set by Aluminium Ltd of Canada a few days earlier. Aluminum Co of America raised its price on pig by 1.3¢ to 26¢ a pound. Fabricators including wire and cable mills were almost certain to follow—it was mainly a question of how much and when. The increase on pig aluminum brings the price back to the April 1958 levels.

OIL ▶ **Don't read too much into the hike in residual oil quotas** for the first half of next year, announced early this month by the Interior Dept. The increase—62,000 barrels a day more than presently authorized—will probably stabilize prices for the winter; but it doesn't signal a major policy shift. Privately, Interior considers the new quota level to be a victory for the coal men, who had been bracing themselves for a bigger increase.

OUTLOOK ▶ **A 13% increase in new orders** for the entire electrical manufacturing industry is predicted for 1960 by Westinghouse President Mark W. Cresap, Jr. Orders for capital goods are expected to climb 20% higher than in 1959 to meet power demand of the mid sixties.

PREVIEW ▶ **For a preview of the new types of equipment** and materials that you'll be ordering in the decade ahead, take a look at the staff report on Survey of the Sixties which begins on **page 69**.

News of Manufacturers ..... page 96
New Equipment ..... page 108
Readers Service ..... page 116

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors: URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Aluminum Conductors: Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	**230**	105	**87.4**
4	155	170	163	**143**	73.3	**53.3**
6	103	115	108	**91.5**	51.5	**35.0**
Solid						
2	239	260	232	**219**	92.2	**79.2**
4	151	164	152	**136**	64.0	**48.0**
6	100	112	101	**87**	45.7	**31.7**

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean . . . free-stripping . . . has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits . . . when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous . . . tough . . . resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene . . . The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

U. S. Industrial Chemicals Co.
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Please send me:
- ☐ "Polyethylene . . . The Best Line Wire Covering"
- ☐ "PETROTHENE Resins for the Wire and Cable Industry"

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Branches in principal cities

Introducing . . .

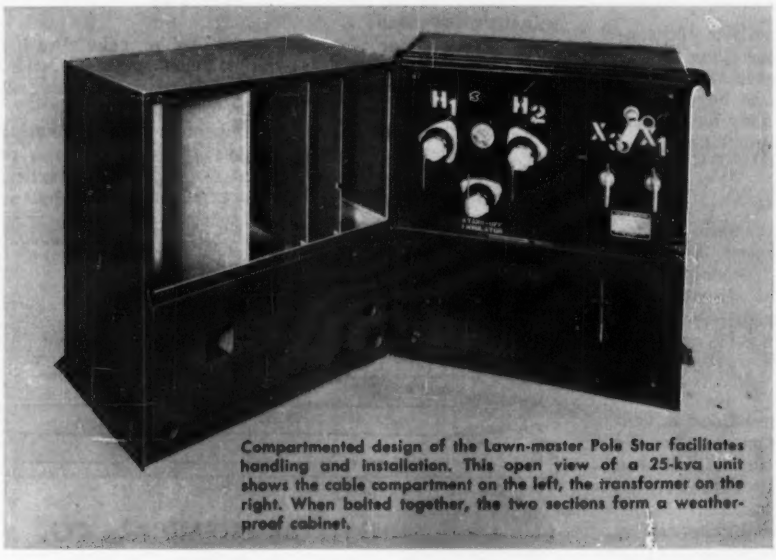
PENNSYLVANIA'S NEW *Lawn-master* POLE STAR

The Surface-mounted Transformer designed with PEOPLE in mind

- **Convenient surface unit for modern, underground distribution systems**
- **Compact, view-enhancing—easy to camouflage with shrubbery, small trees**
- **Easily uprated—each compartment accommodates three different kva ratings**
- **Trouble-free and safe for any location—completely enclosed, with no sharp projections**

Pennsylvania's Lawn-master Pole Star is a transformer designed for "better living" in the fullest possible sense. Specifically intended for use with underground distribution systems, the Lawn-master Pole Star is compact and unobtrusive. Thus, it does not detract from the open vistas created by the elimination of poles and overhead wires.

The Lawn-master Pole Star will provide the continuity of service that homeowners and other power users can expect as a result of underground distribution. All live parts are completely contained in the grounded, weatherproof compartment, thus making the Lawn-master perfectly safe in *any* location, from parking lots to playgrounds. Internally, the Lawn-master features the time-tested Pole Star assembly—with the recently improved "echelon lap" core, which attains new highs in electrical efficiency.



Compartmented design of the Lawn-master Pole Star facilitates handling and installation. This open view of a 25-kva unit shows the cable compartment on the left, the transformer on the right. When bolted together, the two sections form a weatherproof cabinet.

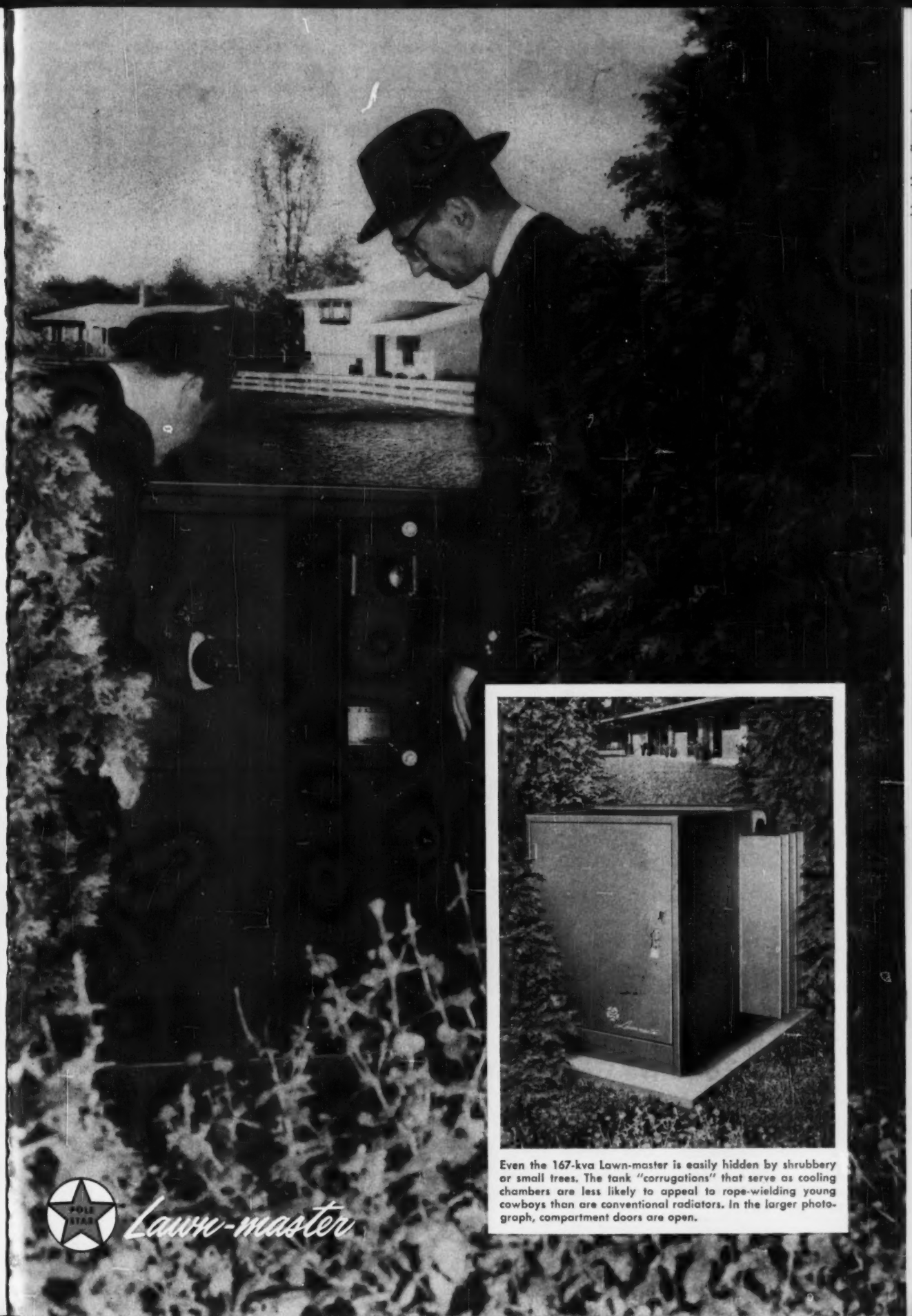
Compartmented design simplifies the handling and installation of Lawn-master Pole Stars. If desired, the cable compartment alone can be installed and then the transformer can be added when service is required. Each compartment accommodates three different kva ratings, so that future expansion is easily accomplished.

Available ratings include all standard sizes from 25 through 167 kva, single phase, and 75 through 500 kva, three phase—15 kv and below. Optional equipment includes transfer switches, standoff insulators and lightning arrester mounting brackets.

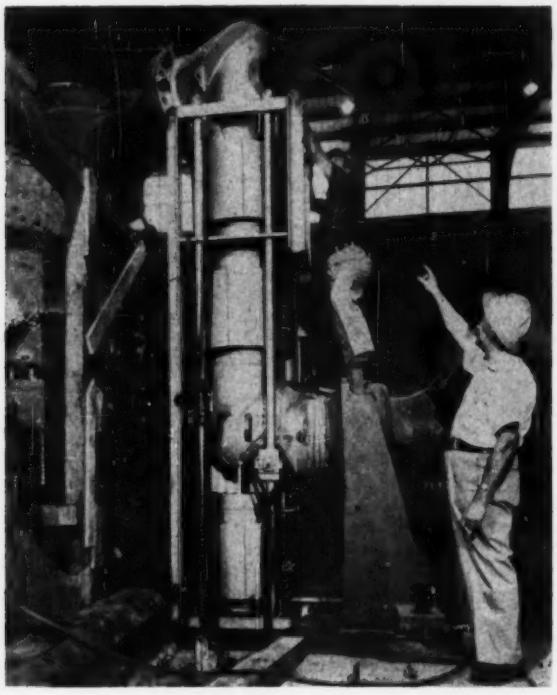
For additional information on the Lawn-master Pole Star — the transformer designed with *your customers* in mind—contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA DISTRIBUTION TRANSFORMERS



Even the 167-kva Lawn-master is easily hidden by shrubbery or small trees. The tank "corrugations" that serve as cooling chambers are less likely to appeal to rope-wielding young cowboys than are conventional radiators. In the larger photograph, compartment doors are open.



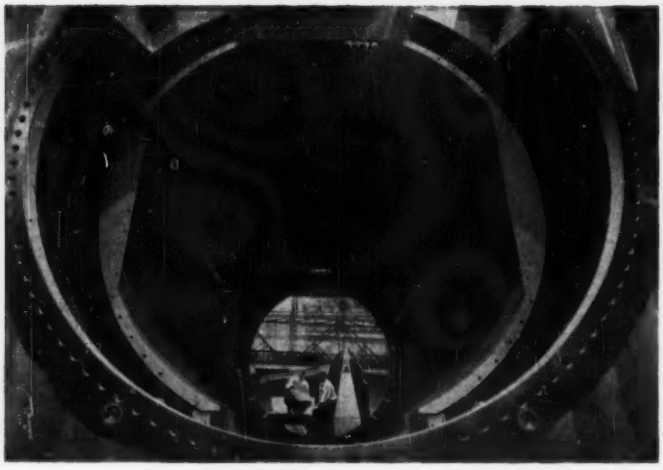
◀Toroidal Expansion Joints Protect 325-Mw T-G

Universal toroidal pressure-balanced expansion joints (left) were selected for the intermediate pressure element of the 325-Mw super-pressure turbine-generator at Philadelphia Electric Co's new Eddystone generating station. When the plant goes into operation next fall, four of these joints will be safeguarding the element from effects of thermal expansion created by cyclic operation to 1050F at 251 psia.

The expansion joints were made by Zallea Bros, Wilmington, Del. Measuring 20 in. inside dia, they absorb thermal expansion of pipe and turbine casing, both axial and lateral, to provide minimum stresses in the turbine casing.

Toroidal corrugations were hydraulically formed in each bellows to meet cyclic life as specified. Each joint has a set of three bellows, two at the flow end and the other at the balancing end.

When operating, expansion joints will be anchored at reheat stop valve and absorb movement in axial and lateral directions at flow end bellows (see top of expansion joint).



▲Steel Frame, 14x30 Ft, Houses 384-Mva Generator

This steel frame, over 14 ft in diameter and 30 ft long, will house a 384-Mva, 3600-rpm turbine-generator. The unit, under construction at Westinghouse Electric Corp's East Pittsburgh plant, is scheduled for delivery to Arkansas Power & Light's new station near Helena by next summer.

Insulation Industry Discusses Latest and Future Trends

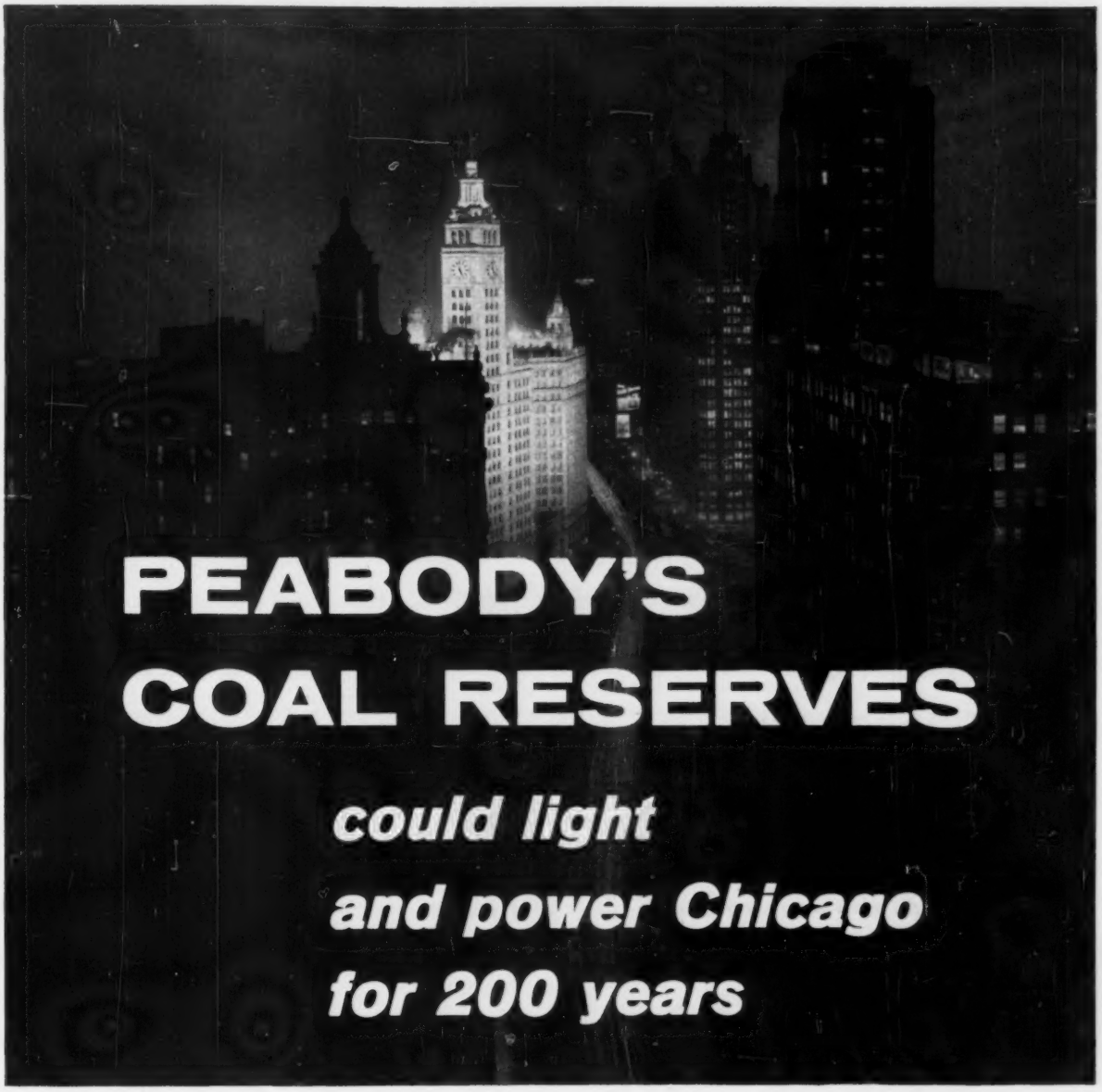
The 1,600 attendees at the second annual National Conference on the Application of Electrical Insulation, meeting in Washington, D.C. December 8-10, discussed trends in their industry and how they can keep abreast of them. From user comments, it was evident that the industry needs to concentrate on greater sustained reliability at higher continous temperatures to meet the more demanding specifications forseen for future years.

Scientists from Western Europe and Russia agreed that problems in their countries almost duplicated those of the United States.

Vice Admiral Hyman Rickover, science award-winner at the convention's banquet, suggested that insulation users should be in the majority on all test groups, rather than those representing the manufacturers' viewpoint. It was predicted that there will be no noticeable shift away from any of the better-known insulating compounds, for all have a place in the industry and are under constant processes of improvement.

Many insulation manufacturers introduced new products at the conference: organic, inorganic, and also hybrid mixtures of the two. Many products used silicone as a base and silicone-rubber compounds.

(*More Manufacturers News, p* 98)



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could light and power Chicago for 200 years

It takes a lot of electrical energy to light and power a modern city, and it takes millions of tons of coal to generate that electricity. That's why many of the nation's major electric utilities and large industries depend on PEABODY Coal. Long-term contracts assure them a dependable fuel source, backed by PEABODY'S two billion tons of proven reserves. And PEABODY'S ultramodern mining, processing and shipping equipment is geared to provide this coal "tailor-made" for their particular needs . . . efficiently and economically. If this is the fuel service YOU need, check with PEABODY first!

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ACCO *Aluminized* CORE WIRE

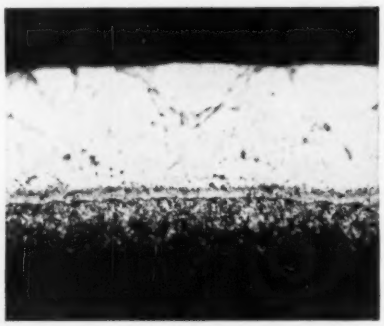
Outlasts Galvanized at least 2:1!

Page ACCO *Aluminized* core wire for ACSR provides all the strength of steel plus the corrosion-resistance of aluminum. An adherent, ductile coating of aluminum is applied by Page's patented hot dip method. Salt spray testing conducted according to ASTM procedures proves that ACCO *Aluminized* wire should last *at least twice as long as galvanized.*

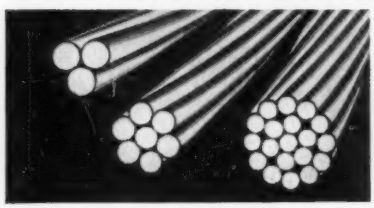
It is available from leading manufacturers of ACSR who have recognized the advantages of stranding aluminum conductor wires over an aluminized steel core—eliminating the "third metal" (zinc) in the completed conductor cable. Aluminized steel core wire assures longer life for your ACSR in both marine and industrial atmospheres.

Next time you order conductor cable, specify ACCO *Aluminized* core wire—it gives more reliability per dollar than any other core wire available.

500X magnification at right shows thin aluminum-iron alloy resulting from diffusion of the two metals, and the outer layer of aluminum in the form of a fine-grain cast structure.



OTHER ACCO *Aluminized* STEEL WIRES



ACCO *Aluminized* steel strand is available with 3, 7 and 19-wire construction for guy, ground and messenger wire applications. Offered in Common, Siemens-Martin, High Strength, Extra High Strength, Utility grades.

Page chain link fence of ACCO *Aluminized* wire provides attractive, economical and longer-lasting protection.

Tie wire, telephone and telegraph wire, barbed wire and other products also are available in Page ACCO *Aluminized* wire. Ask us for details.

WRITE FOR DETAILS...

Booklet DH-537 explains the manufacture, properties and uses of Page ACCO *Aluminized* steel wire. Write us at Monessen, Pa., for your copy.

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PAGE *—the source for answers to wire problems*

First Spider Shipped To Tuscarora Plant

The first of twelve generator/motor spiders is shown above leaving Allis-Chalmers' West Allis works on a specially designed well car. Destination is the New York State Power Authority's Tuscarora plant. The 12 generator/motors, each rated 25,000 kva as generators and 37,500 hp as pump motors, will be installed in the largest pump-turbine plant in the world, A-C says.

Radio Signaling Decoder Alerts Individual Vehicles

Motorola has introduced a transistorized "Quick Call" selective signaling decoder for use with its mobile two-way radios.

The new selective calling system enables a radio dispatcher to alert and talk to individual mobile units on his network without bothering other vehicle operators. When transmitting to a single mobile, the dispatcher presses a button on his control console to activate and transmit a pre-set series of tone signals. These signals are received by all mobile units and to the decoders. The decoder in the desired mobile activates its receiver's audio circuitry upon receipt of the tone code. All others remain inactive. The decoder can be connected to the truck horn, or a light to signal the driver if he is working away from his vehicle.

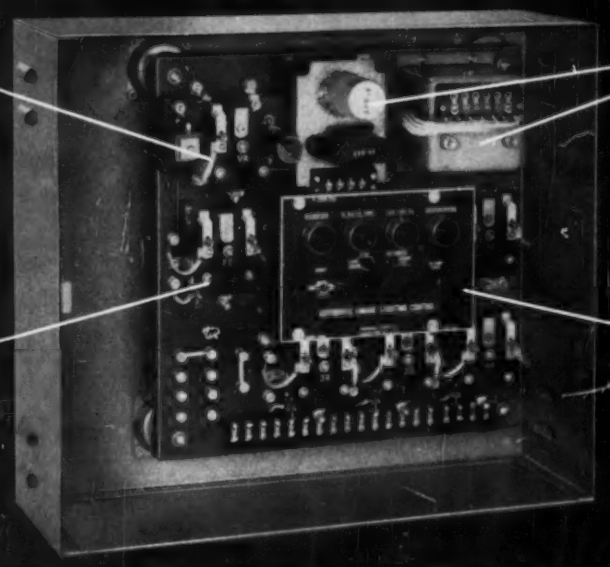
(*Manufacturers Literature, p* 102)

ONE OF A SERIES: ASCO Complete Emergency Control Systems put Standby Power in action FAST

Unique crank disconnect relay prevents recranking at full engine speed.

Heavy Duty Industrial Components provide dependable, rugged service.

Positive Response Relays do not require critical adjustments or frequent maintenance.



Inverter-Timer Combination assures constant cranking periods despite wide variations in battery voltage and ambient temperature.

Link Connections provide manual or automatic shutdown of engine.

Indicating lamps, fuses, and manually operated switches are integral part of control panel... eliminate wear on cables when door is opened... make unit suitable for switchboard applications.

ASCO Engine Starting Controls offer...

extra protection for your standby power equipment!

ASCO Engine Starting Controls provide fully automatic starting and stopping of diesel or gas engine driven generating sets. They offer the extra protection of a unique disconnect relay which positively prevents recranking while engine is running at full speed... helps eliminate danger of damage to starting gears. And control operation is fast... only 1/30th of a second!

Dependable control by ASCO...

ASCO Electromagnetic Control

ASCO

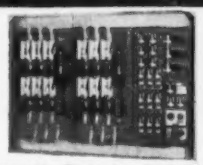
Automatic Switch Co. 50-P HANOVER ROAD, FLORHAM PARK, N.J.
FRONTIER 7-4600

For additional information write for Catalog 57-S6.

Here are other important benefits of new ASCO Controls:

ASCO FEATURE	YOUR BENEFIT
Controls designed to respond at 50% of normal battery voltage.	Assures starting even after high cranking current reduces battery voltage.
Operates over broad ambient temperature range.	Can be installed in unheated areas of plant.
Repeated or continuous cranking cycles provided by same panel.	Makes unit adaptable to all engines.
Industrial control type components throughout.	Provides rugged, sure service, not possible with light duty components.
Motor driven timing device.	Assures accurate control of timing cycles—unaffected by temperatures or other variables.
Can operate from single pole contact on automatic transfer panel or control station.	Reduces installation time and costs.
Coded terminals.	Eliminates guesswork in connecting engine and starting panel; simplifies installation.

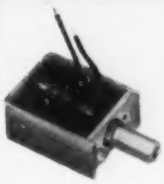
OTHER ASCO CONTROL SYSTEM COMPONENTS:



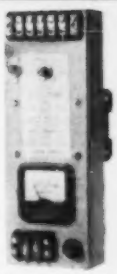
Automatic Transfer Switches *for all classes of load to 750 volts AC-DC. Transfer connected load to standby power when failure or substantial reduction occurs. Return load automatically when full power is restored—in sizes from 10 to 1200 amps. Write for Catalog 57-S1.*

Load Demand Controls *automatically start engine when load is applied; stop it when load is removed. Write for Catalog 57-S6.*

Solenoid Valves *for air starting applications, and for controlling the flow of cooling water, fuel oil and other liquids and gases. Write for Catalog 25.*



Solenoids *for fuel control devices, operating shutters for engine cooling, and other electric plant applications. Write for Catalog 57-S5.*



Battery Chargers *for heavy duty industrial use keep engine generator cranking batteries fully charged. Charger can be combined with automatic transfer panel for compact, single package arrangements. Write for Catalog 57-S6.*

TWO NEW LOW-COST SYSTEMS IBM 1401 CARD... IBM 1401 TAPE

with stored program speed and ability

Never before has so much powerful data processing ability been built into such low-cost systems! For in these two new IBM 1401 Systems you get features previously found only in the larger data processing systems. With 1401 Systems fewer machine units do *more* jobs . . . at *higher* speeds . . . with *greater* accuracy and reliability . . . at *lower* job cost.

To assure you of more production per data processing dollar, IBM's concept of Balanced Data Processing gives you compatible input, processing and output speeds, backed by unequalled customer service. Drawing on all the experience gained in developing the world's largest and fastest computers, these low-cost 1401 Systems bring you these large computer features:

Solid State Design—and transistorized throughout to give you a compact system with greater accuracy and reliability. This powerful system involves no special construction . . . no air conditioning.

Stored Program—gives you the fully automatic processing of electronic systems. It is the key to simplified, economical operation. Completely flexible, a stored program permits you to switch easily from one type of job to another.

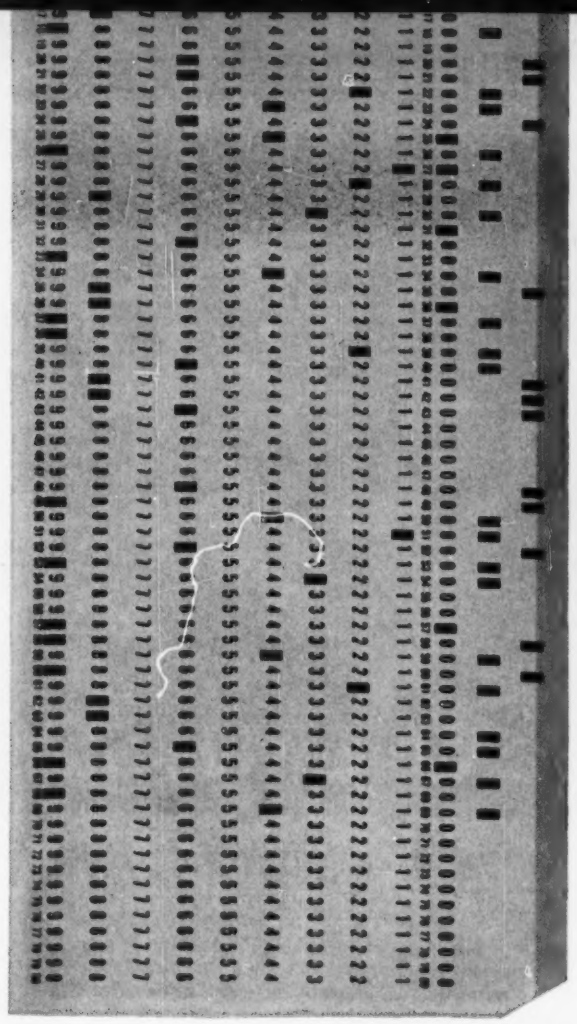
Magnetic Core Storage—the most powerful type storage available. To increase this power even further, the core memory of the 1401 accepts variable-length data and instructions, to permit the storage of only useful information. Choice of 1400, 2000, or 4000 positions of storage means you select the size storage to suit your needs.

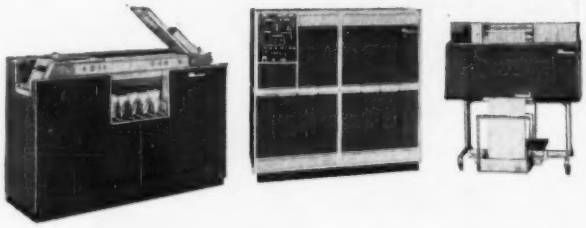
High-Speed Printing—these 1401 systems feature an exclusive new concept of printing. A horizontally rotating chain prints high-quality, perfectly aligned copy. A dual-speed carriage permits printing at the rate of 600 lines a minute, skipping blank paper at 27,000 lines per minute to produce more documents per dollar. Completely flexible editing and print format is provided by the central processor.

Your local IBM representative will explain the many applications and unusual features of the new 1401 Systems. Call him today. These systems, like all IBM data processing systems, may be purchased or leased.

BALANCED DATA PROCESSING

IBM





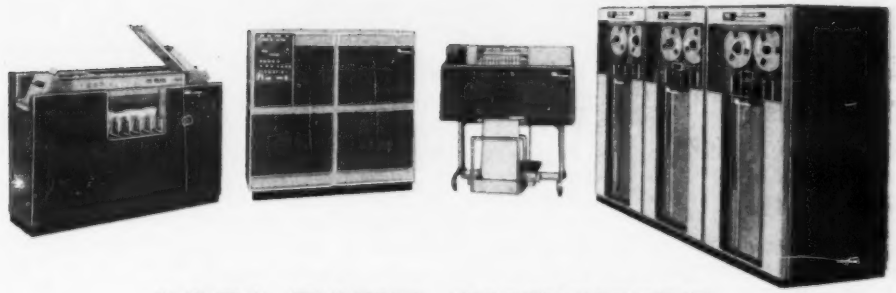
1401 CARD SYSTEMS

These stored program systems now bring the power of electronics to IBM card systems. They automatically handle the work of accounting machine, summary punch, and calculator, but at far greater speed, and with more flexibility and accuracy.

Input is faster—IBM cards are read into the system at the rate of 800 per minute. Data is processed automatically under stored-program control. Manual card handling is minimized.

Output is faster—documents are printed at the rate of 600 lines per minute, cards punched at 250 per minute. The system will turn out, for example, as many as 230 checks in one minute—again, more documents per dollar through Balanced Data Processing!

Thru-put is faster—data flow is automatically checked for accuracy and speeded all along the line. A unique Card Read-Punch combines card input, output, and summary punching functions. Five radial stackers accept cards that are selectively separated under stored program control.

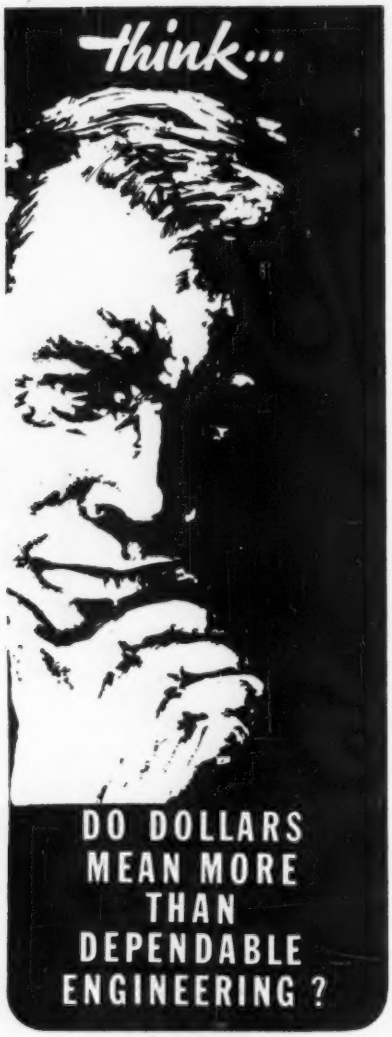


1401 TAPE SYSTEMS

IBM 1401 Tape Systems give you added power through use of up to six magnetic tape units. These units feed data into the system at the rate of up to 62,500 characters per second . . . record processed results at this same peak speed.

1401 Tape Systems are also extremely valuable as off-line auxiliaries to large data processing systems. They can edit tapes prepared for larger IBM systems. They make possible a tape-oriented IBM 7070 configuration that provides higher speed input and output and makes for job cost improvement.

When tape units are added to 1401 Systems, you get greater flexibility and storage advantages, too. IBM tapes provide extremely compact storage of variable-length records—the equivalent of 129,000 IBM cards on a single reel. Tape records can be of variable length, and are read into and out of the system automatically. Also, tapes can be erased and re-used to minimize your record-keeping costs.



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MANUFACTURERS LITERATURE

TUBING . . . two general purpose steels which lend themselves to standardization: #4620, carburizing grade and #4340, full hardening grade. General characteristics and technical data, discussion of how to make tubing selection. Folder TDC-193, 6 pages. Babcock & Wilcox, Beaver Falls, Pa. **(K1)**

CIRCUIT BREAKERS . . . molded case. Complete line, with ratings, specifications and operating characteristics. Illustrations for the smallest for lighting circuit protection through those with 100,000-amp interrupting capacities, also special-purpose breakers. Tables and charts. Bulletin No. 5001-1A, 40 pages. I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Pa. **(K2)**

WELDING . . . of "problem" steels: low-alloy, high-tensile steel and other alloy steels, with the aid of preheat. Includes outlines of physical and chemical changes. "Guide to Preheat," Bulletin E 16-59, 44 pages. J. B. Nottingham & Co, Inc, 441 Lexington Ave, NY 17, NY. **(K3)**

POWER CAPACITORS . . . 50 kvar, "Isokraft 50," and in-line and twin-cluster pole-top equipments designed to provide fixed and switched capacitor banks for distribution circuits. Illustrations, graphs, drawings, and wiring diagrams. Bulletin GEA-6990, 12 pages. General Electric Co, Schenectady 5, N.Y. **(K4)**

SCIENTIFIC AND TEST INSTRUMENTS . . . including dc amplifiers, data handling systems, lab & calibration instruments, magnetic tape instrumentation, nuclear instrumentation, oscillographs, recorders & indicators, servo components, temperature controllers, and transducers. Catalog G-10, 48 pages. Minneapolis-Honeywell Regulator Co, Station M-321, Wayne & Windrim Aves, Philadelphia 44, Pa. **(K5)**

DISTRIBUTION TRANSFORMERS . . . overhead-type described, including standards, application information, design and operating features, accessories, ordering information. Single-phase transformers with standard ratings of 2.4 through 67 kv and 5 through 500 kva. Bulletin DT2, 28 pages. Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis. **(K6)**

STEEL DOORS . . . 14 types of rolling steel doors to meet industrial and commercial requirements. Standard hand, mechanically and power-operated, both Underwriters' labeled and non-labeled types. Engineering specifications given. Also covers window shutters and grilles, room partitioning openings, automatic fire doors. Catalog G-60, 14 pages. R. C. Mahon Co, East 8-Mile Rd, Detroit 34, Mich. **(K7)**

INTERRUPTING CAPACITY . . . chart, revised version. Users of circuit breakers may select and order proper breaker for each application. Revised to include new breakers JK, JKL, and the four Mark 75's. SA-8163-A. Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa. **(K8)**

MOTOR CONTROL CENTERS . . . ac, with specifications, space requirement tables for control components, descriptions of equipment designed for use in the control centers. Includes "plan-it-yourself" forms in back flap. Centers house variety of combinations of circuit breakers, combination starters, magnetic starters, control relays. Bulletin PL6200, 12 pages. Clark Controller Co, Cleveland, Ohio. **(K9)**

ANNUNCIATOR SYSTEMS . . . function and applications. Mechanical and engineering data given for various types to aid in selection. Twelve systems covered. Descriptions and engineering data on components and related equipment. Catalog 100C, 52 pages. Panalarm Div, Panellit, Inc, 7401 N. Hamlin Ave, Skokie, Ill. **(K10)**

PRODUCTION CONTROL . . . internal data collecting system, Friden Collectadata system, accumulates up-to-the-minute records each day from start-work to shipping. Positive control exercised over stockroom and work-in-process inventory. Technical manual, 19 pages. Friden Inc, 1 Leighton Ave, Rochester 2, N.Y. **(K11)**

HYDRAULIC JET CLEANERS . . . for plant and tank cleaning. Six models for heavy-duty cleaning of walls, floors and process equipment described, also three models for cleaning inside of tank cars and tank trucks or stationary tanks, also equipment for cleaning steam injectors. Bulletin 442, 4 pages. Sellers Injector Corp, 1600 Hamilton St, Phila 30, Pa. **(K12)**

(*More Procurement & Products p* 108)

VICTOR suspensions

make dollars and sense

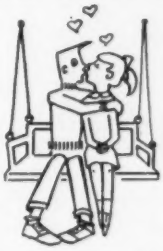
WHY SPECIFY VICTOR?

When you're buying insulators for your lines, don't go about it blindly. Buy the Suspension with an enviable reputation for performance . . . made by a company that's famous for service at the factory and in the field. VICTOR Suspension Insulators are used by many of the nation's foremost utilities on HV and EHV lines. And why not? They are premium products, yet they cost no more than others. Remember—insulators have been made at VICTOR since 1893. To VICTOR, insulator-making is a science. Scientific methods together with meticulous attention to detail have made VICTOR insulators the finest that are available. Put up VICTOR Suspensions today and the chances are you won't ever replace them . . . they will last that long! It's smart buying to buy VICTOR. Makes dollars for you . . . and sense, too.

AIR-CONDITIONED COMFORT

Yes, sir, VICTOR insulators are treated better than most people! We even give them temperature-humidity controlled atmosphere to breathe while the cement that holds cap, shell and pin together, sets and hardens. Reason for such pampering is to prevent cemented assemblies from losing moisture too rapidly . . . permitting them to set properly and attain greatest bonding strength. It's a small detail in the entire VICTOR manufacturing procedure. But, a lot of small details like this result in better Suspensions . . . VICTOR Suspensions.

MAKING SURE A HOT LINE WON'T GET COLD



The *Purified* Porcelain VICTOR uses in all its suspension insulators is your best assurance against the hazards of weather. This finest insulator porcelain ever made has unequalled ability to withstand stress and strains due to ice, snow and high winds. They endure thermal variations way above EEI-NEMA standards. They make dollars and sense for any power man.

WE SOCK 'EM WITH A HAMMER!

If there were a Society for the Prevention of Cruelty to Insulators, we'd be in trouble most of the time! There's no arguing the fact . . . we treat 'em rough when it comes to testing them for impact. In our test laboratories, our quality control procedure subjects VICTOR Suspensions to impact steps far in excess of EEI-NEMA standards by means of a hammer of known weight falling at predetermined heights and striking the outer edge of the insulator shell. These rather drastic tests do destroy quite a few insulators. That's bad! But they do make sure that the VICTOR Suspensions you get have greater resistance to impact than any other suspension insulators you can buy. That's good!

DO YOU KNOW THAT . . .

- VICTOR's plant began producing wet process porcelain in 1893?
- VICTOR's Craftsmen have a total of more years of insulator-making experience than those of any other plant in the industry?
- VICTOR was the first to use demineralized water for all processing?
- VICTOR pioneered the use of infrared drying of insulators?
- VICTOR was among the first to use silicon carbide kiln furniture?
- VICTOR pioneered the use of modern tunnel kilns equipped for recirculation of kiln gases?
- VICTOR was the first to use American clays exclusively?

For full information on VICTOR Suspension Insulators, write I-T-E Circuit Breaker Company, Victor Insulators Division, Victor, N.Y.

VICTOR NO. 900
Suspension Insulator

I-T-E CIRCUIT BREAKER COMPANY
VICTOR INSULATORS DIVISION

REYNOLDS STRIP

Dings Lifting Magnet
100% productive use of coil space for a more powerful, lighter weight magnet, designed with Reynolds Anodized Strip Conductor.

Controlarc DC Arc Welder
A lighter weight, more rugged unit capable of withstanding severe overloads, thanks to Reynolds Anodized Strip Conductor.

A. O. Smith AC-DC Convertor
More performance packed into a smaller housing—Reynolds Anodized Strip Conductor eliminates bulky insulation. Good production savings.

Sparton Automotive Horn
Reynolds Interleaved Strip Conductor eliminated eleven parts, provides improved performance, production efficiencies.

SOME LEADING MANUFACTURERS AND THEIR APPLICATIONS OF REYNOLDS ALUMINUM STRIP CONDUCTOR

Caledonia-Transformer
1955 Electronic Transformer, Interleaved Sheet

Dings Magnetic Separator
1956 Lift Magnets, Anodized Strip

Vickers Electric
1956 Transformer Welder, Anodized Strip

Harnischfeger
1957 Clutch Coils, Anodized Strip

Lincoln Electric
1957 Arc Welders, Interleaved Sheet

Jefferson Electric
1958 Dry-type Transformers, Anodized Strip

General Electric
1958 Control Coils, Interleaved Foil

Calidyne
1958 Shaker Coils, Anodized Strip

Delco Remy
1958 Alternator Field Coils, Interleaved Foil

A. O. Smith
1959 Arc Welders, Anodized Strip

Cutler Hammer
1959 Lift Magnets, Anodized Strip

Westinghouse
1959 Specialty Dry-type Transformers, Interleaved Sheet

Sparton Automotive
1959 Horn Coils, Interleaved Foil

ALUMINUM CONDUCTOR

Reynolds 1955 development continues to find new uses in improving products and reducing costs in the electrical industry

Four years of progress is paying important user dividends

Introduced in 1955, Reynolds Aluminum Strip Conductor—anodized and interleaved—was hailed immediately as an excellent new way to solve numerous production problems and costs associated with conventional wire coils.

A pilot laboratory for winding strip coils was established and hundreds of varying sizes and types were prepared. During this time, Reynolds Product Development Department worked with many electrical equipment manufacturers. This pooling of talent helped hasten and expand the practical application areas for Reynolds Aluminum Strip Conductor. As an example, the Utica Koldweld Division of Kelsey-Hayes assisted Reynolds in developing new tools and methods for the joining of the conductor.

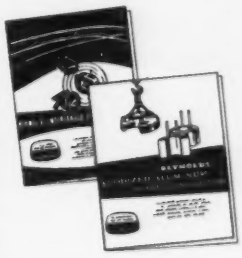
Year by year, new uses have been found for Reynolds Aluminum Strip Conductor in a wide variety of electrical equipment. The first production use was in 1955 in electronic transformers made by the Caledonia Transformer Company; the most recent is this year's use in new automotive horns made by Sparton Automotive. And over the years, Reynolds Aluminum Strip Conductor has been used in lift magnets, transformers and convertors. Its potential in large and small equipment is almost unlimited.

Winding ease . . . insulation savings . . . improved heat transfer . . . reduced layer-to-layer voltages: key benefits offered by this proved product

Reynolds Aluminum Strip Conductor eliminates bulky insulations. It lessens the danger of burnout by offering better heat transfer characteristics, reduces layer-to-layer voltages, increases coil efficiency. In manufacturing, it provides exceptional winding ease and simple mechanical joining. And with its high conductivity and low weight, it saves both space and weight. These benefits, and others, add up to a better coil, a less expensive coil.

Reynolds Aluminum Strip Conductor is available in two forms: interleaved or anodized. The interleaved form is furnished by Reynolds in coil form and can be wound with the customer's choice of interleaving material. Anodized strip is customarily used in the heavier gauges in transformers, magnetic clutches and brakes. Whatever the choice, you can depend on Reynolds, the acknowledged pioneer in the development of aluminum strip conductor.

For more information contact your nearest Reynolds Sales Office or write direct to *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Virginia.*



WRITE TODAY

for these booklets on Reynolds Anodized and Interleaved Strip Conductor. They contain information on actual applications joining and winding and a wire gauge-strip conductor computation chart.

Watch Reynolds TV shows—"ALL STAR GOLF", "BOURBON STREET BEAT" and "ADVENTURES IN PARADISE"—ABC-TV

Specify

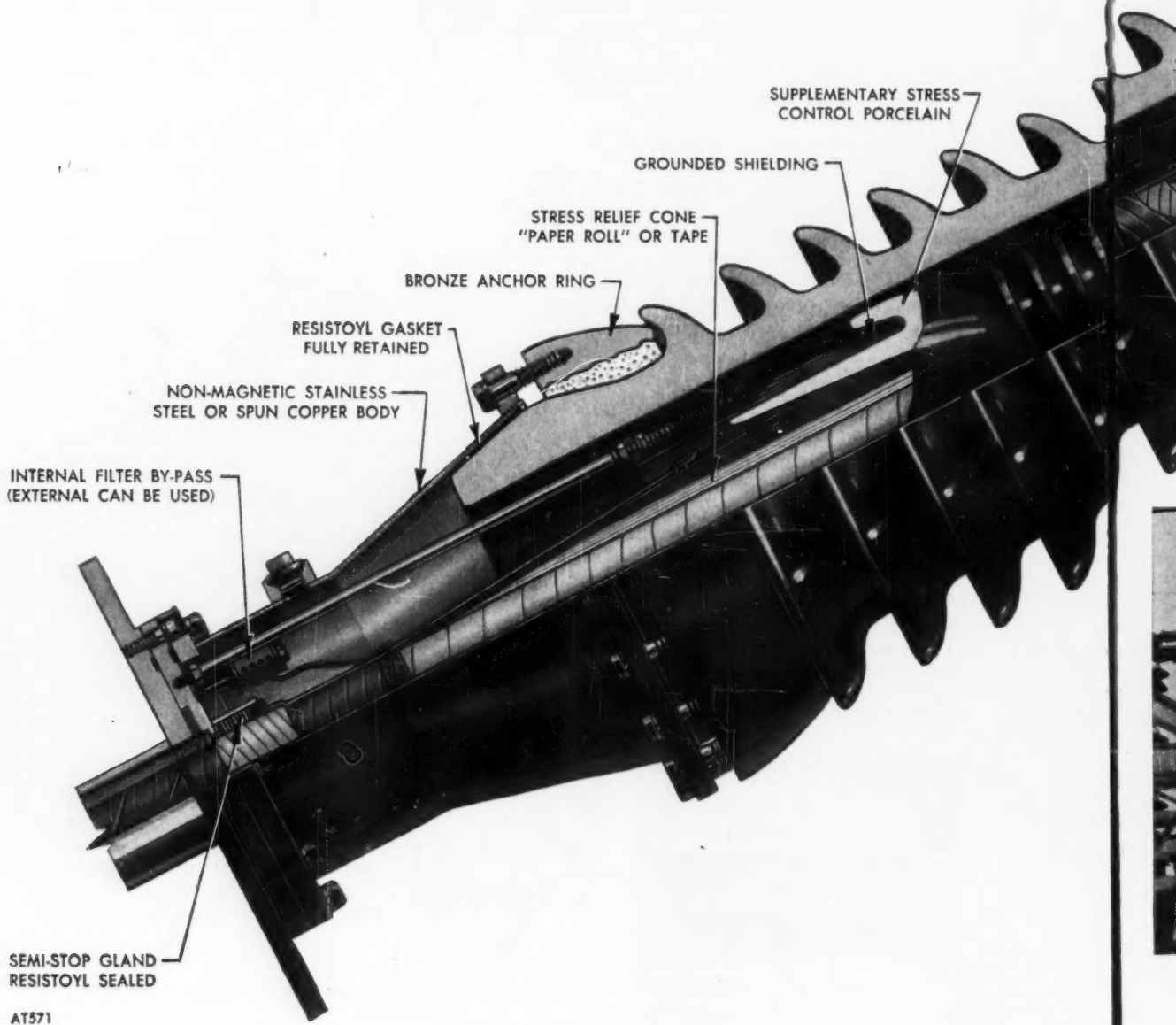
safety, simplicity, ease of installation and maintenance with G&W high voltage (69 to 230kv) cable terminating devices

FEATURES

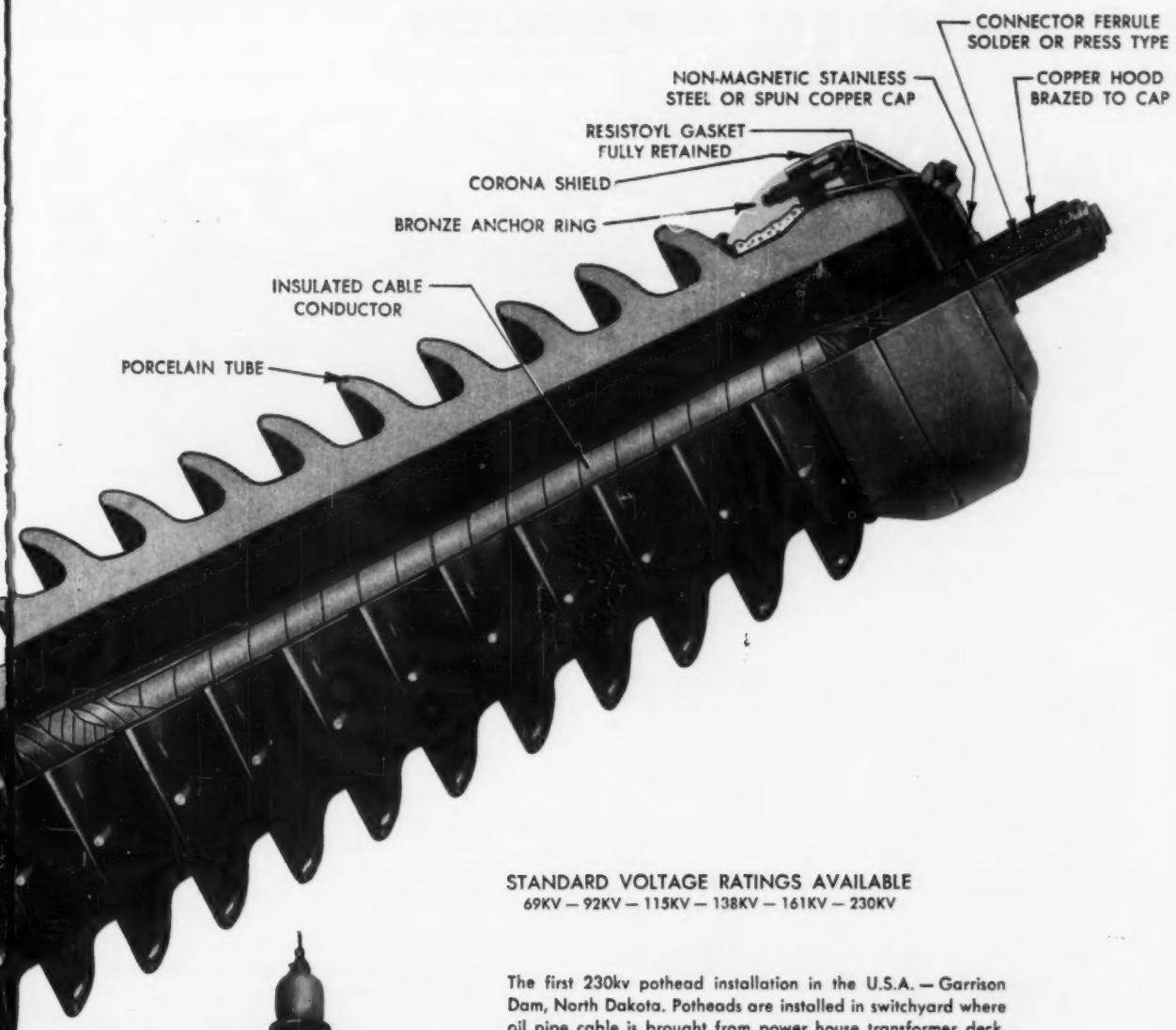
- SIMPLICITY — A minimum of parts, each designed for maximum function.
- VERSATILITY — Method of fabricating base readily adapts it to varying installation conditions.
- NO CASTINGS — Points withstanding pressure, top and bottom fittings, are fabricated non-magnetic stainless steel and spun copper to eliminate hazardous brittle, porous nature of castings that are susceptible to leaks.
- G&W tests exceed A.I.E.E. withstand tests

230kv pothead terminating 1/C, 500mcm, 230kv, PILC, HPOF cable	A.I.E.E. No. 48	Actual Tests
Impulse, 1.5 x 40ms	1050kv	1232kv
60 cycle, 1 minute dry	545kv	575kv
60 cycle, 10 seconds wet	445kv	545kv
60 cycle, 6 hours dry	315kv	340kv

The sound engineering principles of G&W potheads will eliminate the complexities of your cable terminating problems. Their safety, ease of installation and minimum maintenance are essential requirements in which you'll be interested. Notice the features and overall design pioneered by G&W. Specify them with confidence in your plans for high or low pressure oil or gas filled cable systems.

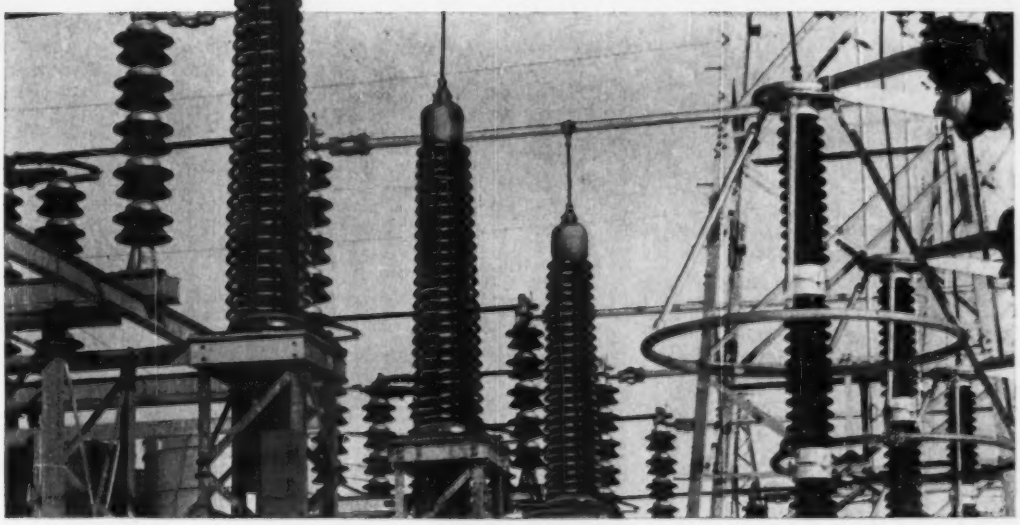

SUPPLEMENTARY STRESS CONTROL PORCELAIN
GROUNDED SHIELDING
STRESS RELIEF CONE "PAPER ROLL" OR TAPE
BRONZE ANCHOR RING
RESISTOYL GASKET FULLY RETAINED
NON-MAGNETIC STAINLESS STEEL OR SPUN COPPER BODY
INTERNAL FILTER BY-PASS (EXTERNAL CAN BE USED)
SEMI-STOP GLAND RESISTOYL SEALED

AT571



STANDARD VOLTAGE RATINGS AVAILABLE
69KV — 92KV — 115KV — 138KV — 161KV — 230KV

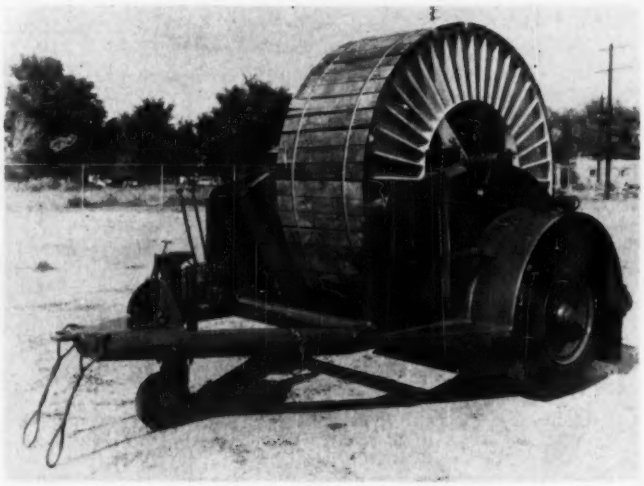
The first 230kv pothead installation in the U.S.A. — Garrison Dam, North Dakota. Potheads are installed in switchyard where oil pipe cable is brought from power house transformer deck.



G&W ELECTRIC SPECIALTY COMPANY
3500 W. 127th ST., BLUE ISLAND, ILLINOIS

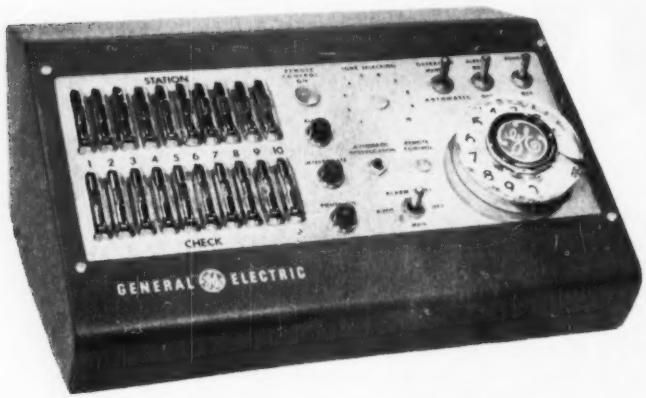
(For further information refer to Readers Service on page 116)

Reel Carrier . . .



. . . accommodates reels up to 62 in. in width. A newly designed axle, wheel and hub assembly enables the Truco Model TCR to accept wider reels. It will handle reels of 96 in. dia and up to 14,000 lb. Available on special order are trailers to handle reels up to 108 in. dia, 72 in. wide and weighing up to 20,000 lb. As an optional accessory, payout tensioning and power pulling equipment may be supplied for any of these trailers.

Truck Equipment Co, 3963 Walnut St, Denver, Colo.

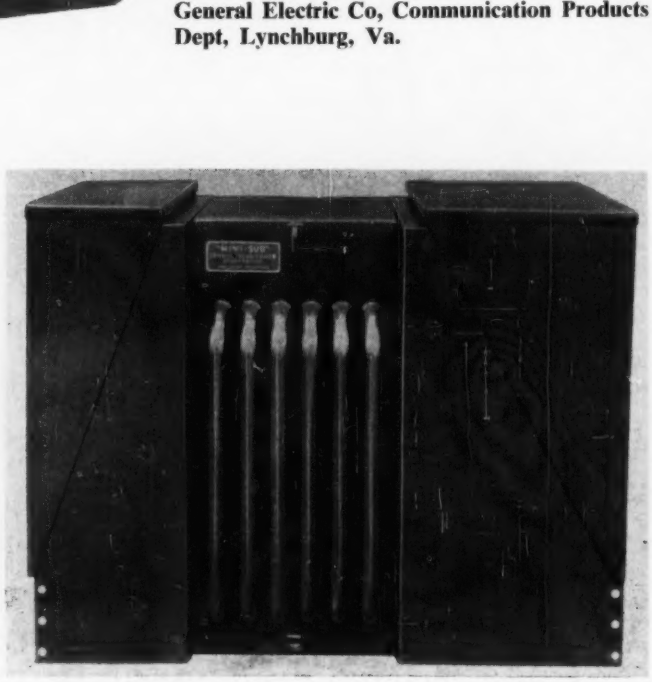


Alarm/Control System . . .

. . . monitors and controls unattended locations remotely from a central point. The equipment may be used with various types of transmission media, such as microwave, carrier current or leased pair. Signals can check up to 100 points, and ten functions can be checked at each point. Signals will indicate whether a pre-scheduled action is taking place at a remote location or whether faults have occurred.

General Electric Co, Communication Products Dept, Lynchburg, Va.

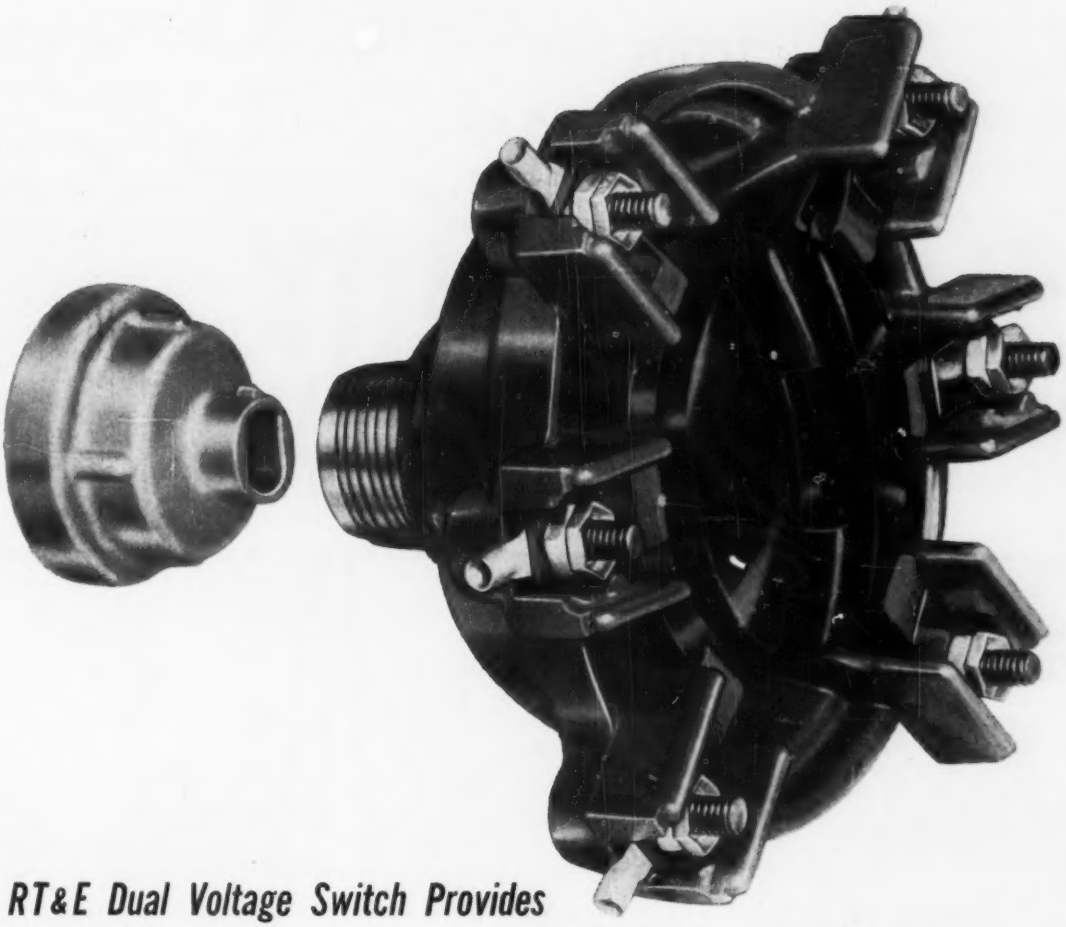
Transformer . . .



. . . for residential underground distribution systems is pad-mounted. Called the Mini-Sub, the unit features high and low voltage compartments separate from the transformer. The three sections form an easily-installed unit. The hv section incorporates a boric acid fuse and disconnects suitable for load-break switching. It is available in sizes 25 through 167 kva in voltages 13,800Y, 13,200Y and 12,470Y to 120/240 v.

Central Transformer Corp, Pine Bluff, Ark.

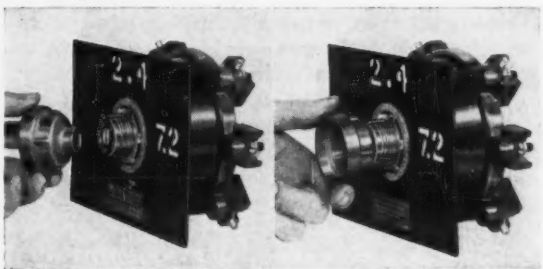
(*More New Equipment on page* 112)



New RT&E Dual Voltage Switch Provides

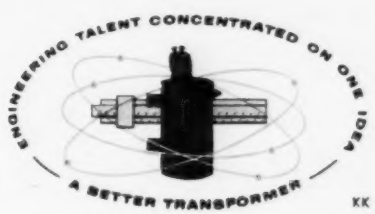
FOOLPROOF OPERATION

You cannot operate this improved RT&E dual voltage switch incorrectly. It can be moved only with the keyed handle provided, and the switch must be correctly positioned before the handle can be removed. This successor to the industry's first externally-operated dual voltage switch demonstrates further proof of RT&E's four years of dual voltage experience. Improvements include a new body of shatterproof polyester glass, dimensionally, chemically, and thermally stable, and new spring-loaded contacts that assure constant positive contact pressure. In addition, this single switch handles both even and odd multiple voltages. Plan to uprate your system now, with RT&E dual voltage equipment — transformers with more built-in experience.



SAFE! Unique keying action between handle and slotted ring around shaft assures positive positioning before handle can be removed.

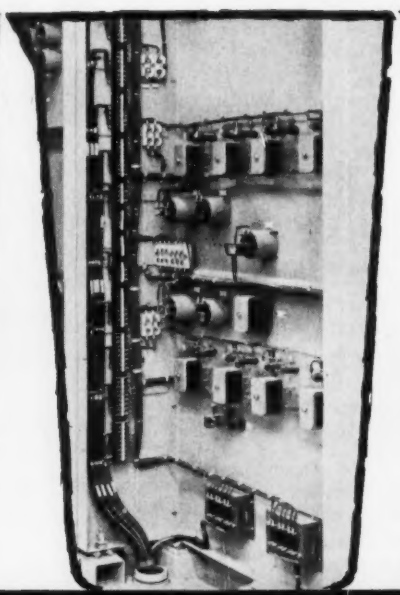
RT&E CORPORATION
WAUKESHA, WISCONSIN
PORTLAND, OREGON



KK

from the
laboratories of
General Cable...

PREMIUM QUALITY INSULATION COMPOUNDS



AQUASEAL

low SIC, superior, rubber compound that is heat and water resistant, used on single and multiple-conductor cables at ratings up to and including 2KV a-c or d-c. Recommended for dry, alternately wet and dry, and continuously wet locations, subject to a-c or d-c potentials at either polarity, and at a maximum conductor temperature of 75C.

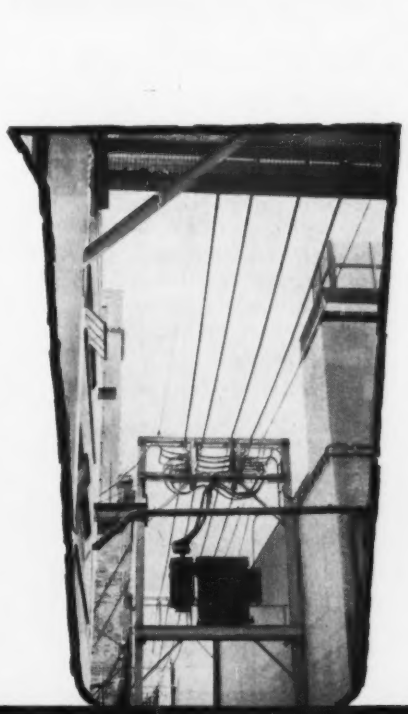
GENCORONE

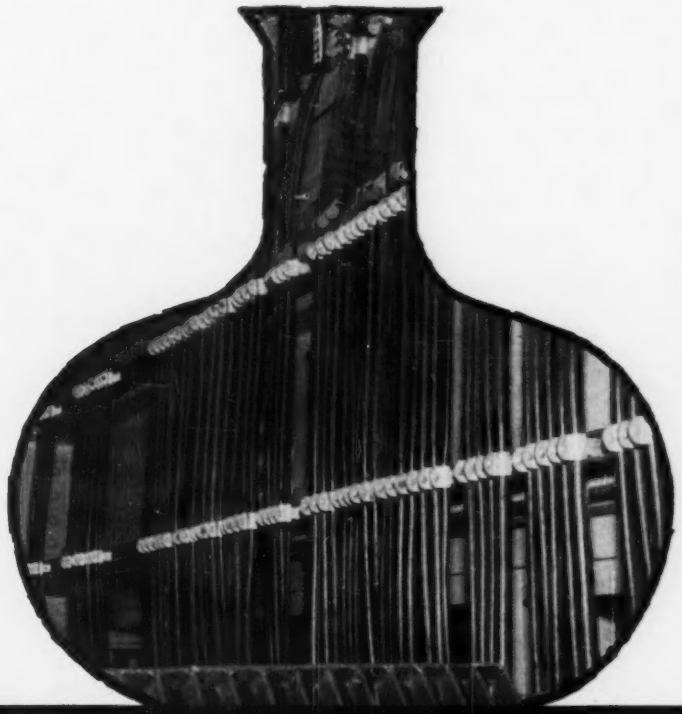
high-voltage, ozone-resistant insulation of the oil base type, with exceptional physical and electrical stability. Resists the effects of moisture, sunlight, weather and earth solutions. Permits liberal current ratings consistent with maximum continuous operating temperatures of 75C for 8KV service or lower and 70C for higher voltages.

BUTARONE

high-voltage, butyl-base compound with exceptional resistance to ozone, low water absorption, and excellent resistance to heat. Suitable for both low and high-voltage applications, it has excellent electrical stability and resistance to aging. Operates at 90C up to 5KV and at 85C at higher voltages.

In the modern General Cable laboratories, some of America's foremost rubber chemists create, test and evaluate new insulation compounds in a continuous program of research and development. Materials for standard service conditions and special constructions to satisfy unusual requirements have all proven their worth in superior performance in power and control cables over many years. A few of the basic compounds from General Cable's long list are briefly described on these pages.





THERMAX-W

and many other compounds in the rubber group are available for low and moderate voltage power cable service in wet locations, where high temperatures are encountered or where high current carrying capacity is required.

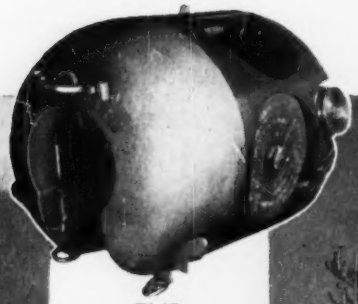
GENCASEAL (PVC)

in the thermoplastic group, as well as high-molecular-weight polyethylene, which is another outstanding General Cable thermoplastic insulation.

Offices and Distributing Centers Coast-to-Coast

GENERAL CABLE CORPORATION, 730 Third Avenue, New York 17, N. Y.

for quality and service specify... **GENERAL CABLE**



Neale Model "K"

END
TREE-TRIMMING
PROBLEMS

•

ELIMINATE
STORM
OUTAGES

with

AERIAL
CABLE

FIELD
SPUN

•

It's Neater
Easy to Install
Proven in the Field

•

The new Model K pull-type Spinner was designed especially for power cables, with a background of many years' experience in telephone cables. It has been adopted as standard by many electric utilities.

- Lashes three cables as large as 2" O.D. at one time.
- Lashes single cable as large as 3½" O.D.
- Lashes with one or two lashing wires.
- Lashes with wire of any type or size.
- Works on any size strand.
- Weighs only 36 pounds (less wire).

For descriptive information and application data please drop us a note.

CABLE SPINNING EQUIPMENT CO.

3100 Topeka Ave. Topeka, Kans.

Phone CE 2-7234

Silicon Rectifier . . .

. . . for high current, high voltage applications is now available. The type 439 rectifier can provide up to 240 amp of forward current per cell with maximum peak inverse voltage ratings up to 600 v. Maximum reverse leakage current is 50 milliamp at the rated peak inverse voltage.
Westinghouse Electric Corp, Box 2088, Pittsburgh 30, Pa.

Portable Winch. . .

. . . and hoist can lift 1,500 lb. The My-Te All-Purpose Electric Hoist operates from any 30 amp 110-v ac circuit. It weighs only 57 lb. Drum speed is 59 rpm, and drum capacity is 150 ft of ¼-in. cable.
City Engineering Co, Inc, Indianapolis, Ind.

Batteries . . .

. . . for switchgear and control applications are available in 50 to 1,140 amp-hr capacities. The new line of light weight calcium batteries is de-

(*Continued on page* 119)

ALLIS-CHALMERS... Pacing Power Progress

Parts simplification and mass production methods.

highest quality regulators at lowest cost to you

Allis-Chalmers three-phase regulators

PACK MORE VALUE

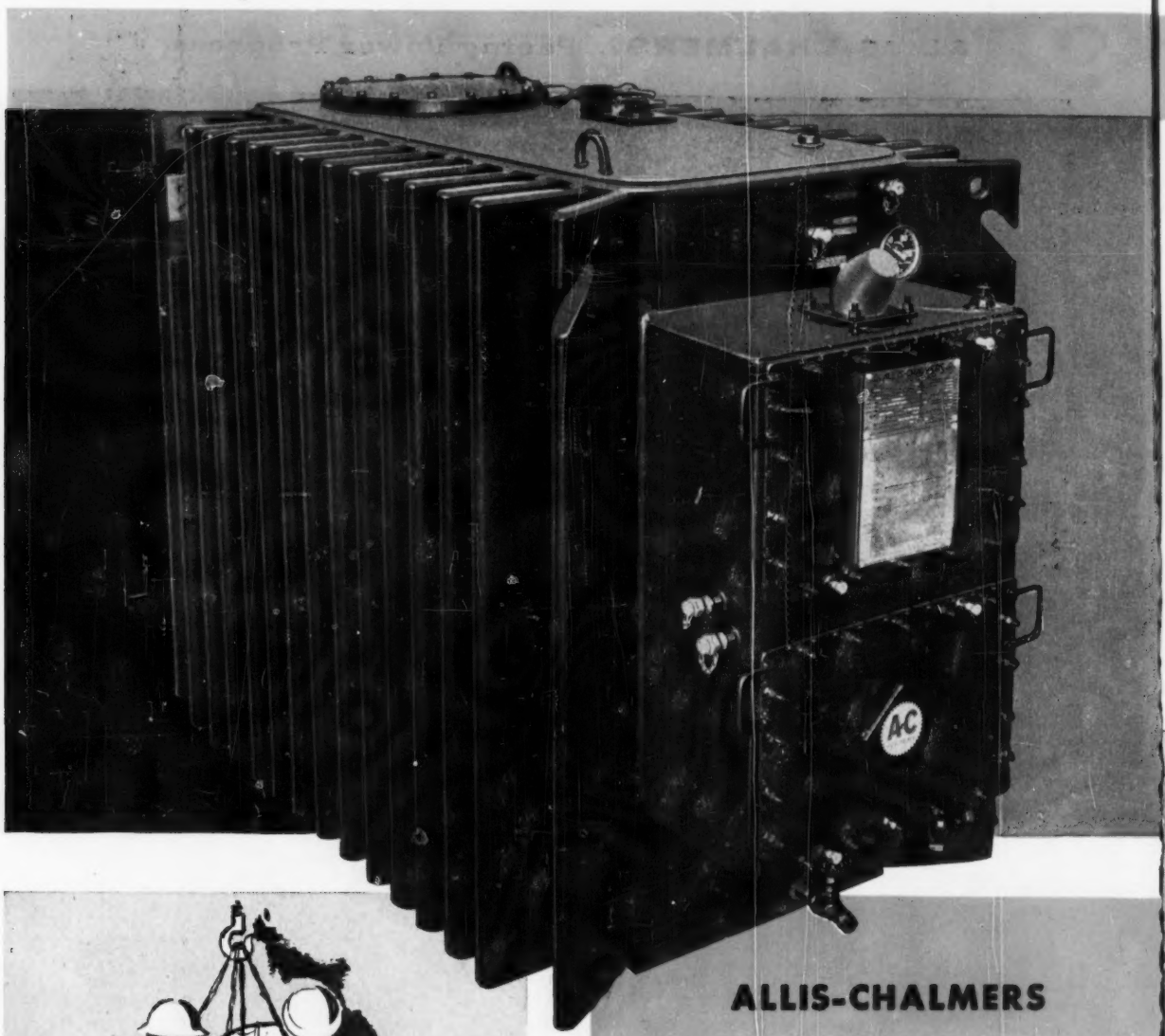
Fewer and cleaner designed components in A-C three-phase regulators drastically cut machining and handling time — speed mass assembly manufacturing. Result: *true* low-cost regulation — yet all these advantages nowhere else available *regardless of price*. 33% less space required, 20% less weight for easy handling, lower installing cost. 30% less cost per kva of three-phase regulation and 160% *Vari-Amp* ratings offered to 600 amp maximum.

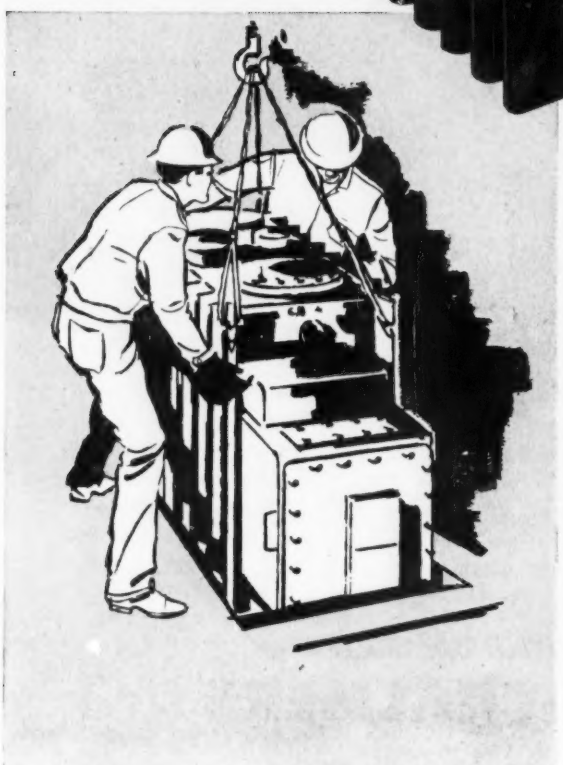
Regulator facts fast! Call, wire or write...

ALLIS-CHALMERS

Originators of 5/8% Step Regulators

A-1206-E





ALLIS-CHALMERS

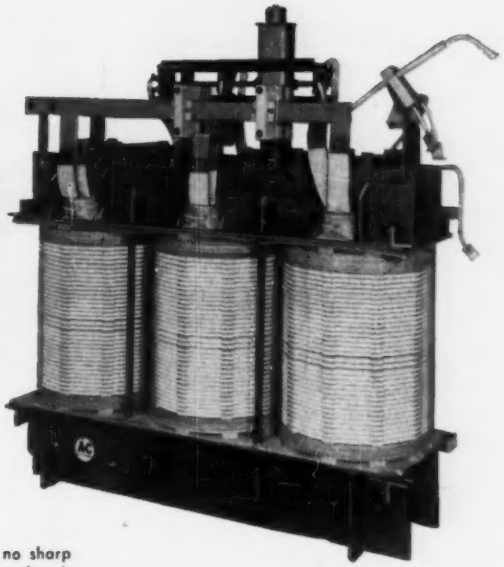
NETWORK TRANSFORMERS

Truly New for True Economy

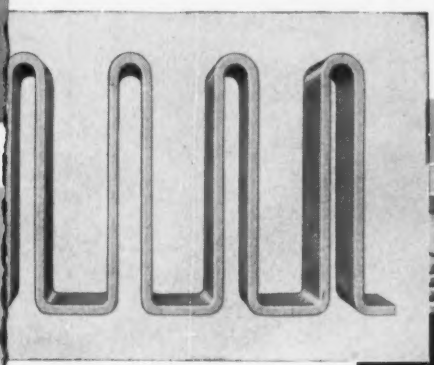
With equipment replacement costs increasing, it's more important than ever to demand maximum transformer value. When you buy that new transformer, look beyond the price tag for the advanced engineering that promises long-range economy. Insist on an assurance of bonus service years. Consider cost-cutting convenience in installation ... in maintenance. In short, specify an Allis-Chalmers network transformer ... the transformer that gives you everything that's new *now* ... the transformer that will stay new for years to come.

ALLIS-CHALMERS... Pacing Power Progress

Smaller Vault Requirements per Kva

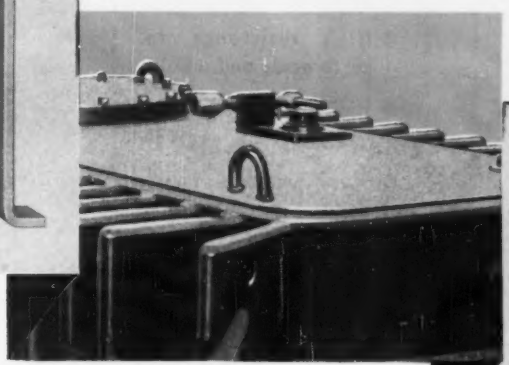


Compact core and coil assembly has reduced overall size and weight by an average of 15%. As a result, increased kva may be installed in existing vaults. Sizable savings are realized in excavation, construction and rental costs. With smaller, lighter transformers to handle, work crew efficiency is improved. From the performance stand-point, the compact core and coil assembly provides greater resistance to surge conditions and short-circuit stresses. Lower exciting current and lower losses afford additional system economies.

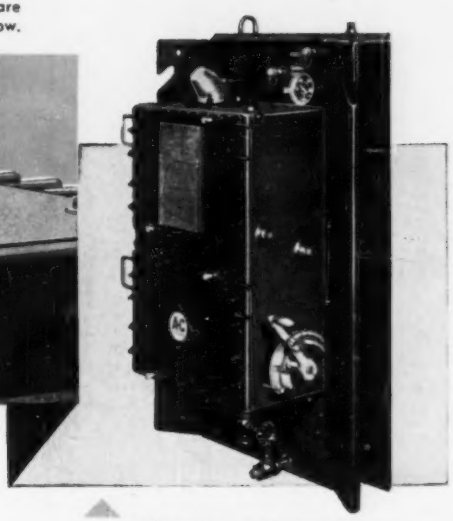


Corrugated tank design has no sharp corners or crevices. Visual inspection is quick and thorough. When repainting becomes necessary, all cooling surfaces are readily accessible with brush, spray or flow.

and Simplified Maintenance



Welding does away with most bolted connections. This results in a surface that stays cleaner longer. Welded-on covers cut maintenance costs considerably by eliminating gaskets.



Grouped easy-to-read, easy-to-operate accessories — Allis-Chalmers pioneered the time-saving convenience of grouped accessories. The importance of this development is reflected in today's industry standards.

For detailed information, call your local Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-1027-E

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

Truck Equipment.....Reel Carrier ☐
GE .....Alarm/Control ☐
Central Transformer..Transformer ☐
Westinghouse .....Rectifier ☐
City Engineering.....Winch ☐
Gould-National .....Batteries ☐
Dow Corning .....Varnish ☐
Joslyn.....Guy Attachment ☐
Distribution & High-Line....Block ☐

MANUFACTURERS LITERATURE

Code No. .....

(Requests are made from code numbers on page 102).

OTHER

Manufacturers Editor
Electrical World
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DECEMBER 28, 195

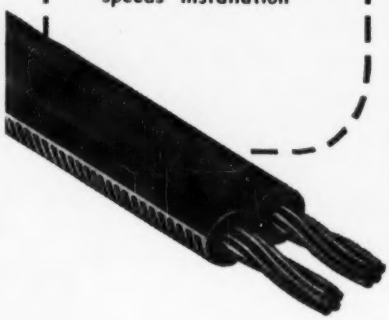
From regulator to lamp
... use cost-saving
SUPERIOR CABLES

Thermoplastic Series Lighting Cables

- High resistance to earth acids and alkalis
- High resistance to sunlight, moisture, weather
- Small diameter, lightweight
- Easy to splice

Figure 8 Pole & Bracket Cable

- High resistance to abrasion, mechanical damage
- Does not deteriorate with age or weather
- Will not support combustion
- Flexible, strips clean, speeds installation



Performance and economy go hand in hand in hand with SUPERIOR plastic insulated and jacketed cables.

All SUPERIOR CABLES are quality-engineered, precision manufactured and thoroughly tested.

From regulator to lamp . . . for low initial cost . . . for less maintenance cost . . . order SUPERIOR CABLES!

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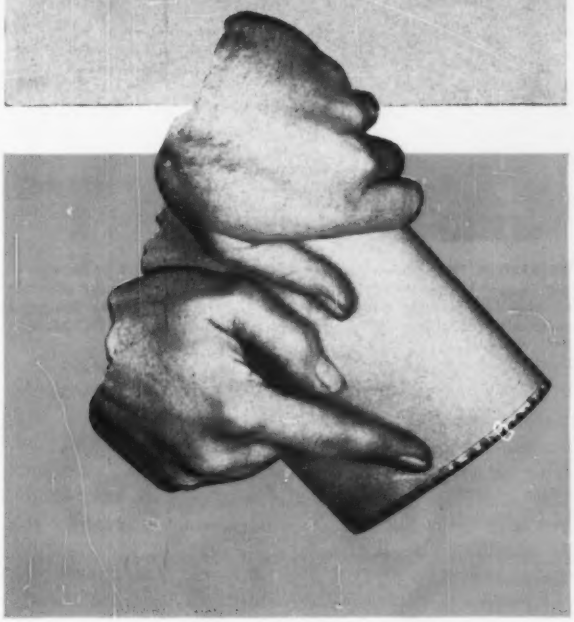
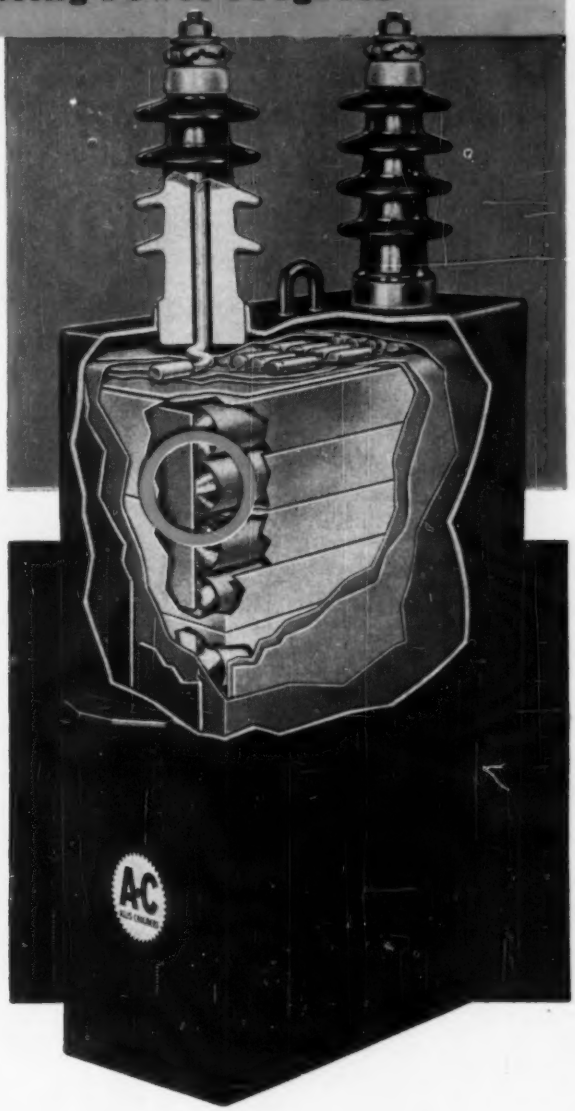
ALLIS-CHALMERS... Pacing Power Progress

EXTENDED-FOIL COOLING...

- reduces hot-spot temperatures
- lengthens service life





New Allis-Chalmers Power-Factor Capacitors

Allis-Chalmers extends aluminum foil *beyond* the ends of each capacitor pack to speed heat dissipation to container sides. Result: *substantial reduction* in hot-spot temperature over ordinary capacitor designs!

And electrical contact is also improved. Broad spring-pressure contact plates press against the long edges of each foil. Losses are minimized; low current density results. Your bonus: extra years of faithful capacitor life . . . extra protection against transient overcurrent induced by lightning, switching surges or capacitor-discharge through nearby line faults.

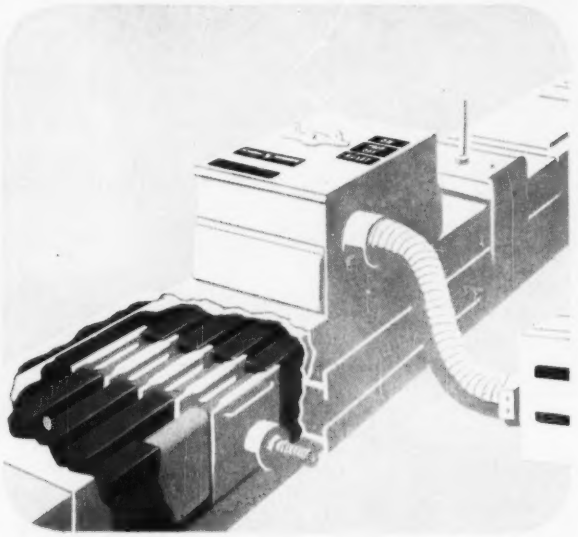
Capacitor Facts Fast! Call, wire or write...

ALLIS-CHALMERS

A-1188-E

ENJAY BUTYL... THE IDEAL RUBBER FOR INSULATION AND JACKETING

RESISTANCE TO MOISTURE – The mechanical water absorption of Butyl insulation in 90° C. water is only about *one-sixth* that of oil base compounds. This is an important characteristic for insulations to be used in direct burial, underground conduits, etc.



RESISTANCE TO HEAT – Because of superior resistance to deterioration caused by heat and traveling arcs, Butyl helps make possible the first low voltage busway system (600 v and below) designed specifically for aluminum conductors.

RESISTANCE TO WEATHERING – Butyl's inherently higher resistance to sunlight, moisture and weathering makes it the ideal material for this indoor-outdoor transformer casing. Integral molding of external parts provides reliable weatherproof insulation.

RESISTANCE TO AGING – Butyl is virtually ageless. That's why it was selected to stand up to sunlight and ozone in outdoor watt-hour meters. Butyl provides dependable insulation and must resist all weather conditions for 30 years.

Enjay Butyl is the best of the vulcanizable rubbers, either natural or synthetic, from the standpoint of electrical and dielectric properties, ozone and corona resistance, heat and moisture resistance, and long aging. Find out how versatile, low cost Butyl can help improve your products. For more information call or write your nearest Enjay office.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY COMPANY, INC., *15 West 51st Street, New York 19, N. Y.*

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ENJAY® BUTYL

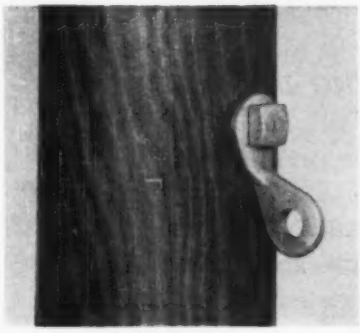
Batteries . . .

(*Continued from page* 112)

signed for full float service. Units are housed in light weight, high impact resistant Plastrite jars.
Industrial Div, Gould-National Batteries, Inc, Trenton 7, N. J.

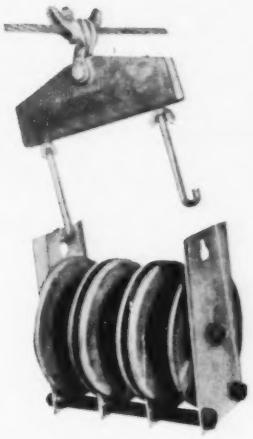
Silicone Varnish . . .

. . . cures in only 6 hr at 150C. Designated Dow Corning 980 varnish, the material meets AIEE requirements for use in 220C systems. In addition, it resists moisture and is unaffected by many corrosive atmospheres. Run-off is low, providing savings in equipment maintenance and clean-up time.
Dow Corning Corp, Midland, Mich.



Guy Attachment . . .

. . . is a strong, single-bolt fitting for fastening a wood strain insulator to a pole. The J2575 Guy Attachment provides the closest possible coupling between the pole bolt and the insulator. The angle of the down guy can be varied without bending the guy attachment because of the position of the hole for the strain insulator. Forged from copper-bearing steel, with $\frac{13}{16}$-in. holes for $\frac{3}{4}$-in. bolts, it is hot dip galvanized.
Joslyn Mfg and Supply Co, 155 N Wacker Dr, Chicago, Ill.



Stringing Block . . .

. . . mounts three 8-in. dia x 2-in. sheaves on one heavy yoke. Sheaves are furnished with $\frac{3}{8}$-in. thick, replaceable bottom groove liners, permitting single "bull-line" stringing of two or three cables in one-pull operation. Blocks can be mounted at the pole on the messenger with angle clamp, or with clevis fittings to fasten on pole support brackets. It is known as No. PPM-30.
Distribution and High-Line Specialties Co, 2100 Del Norte, St. Louis 17, Mo.

More New Products

Recording thermometer with dry stylus is highly portable. Called model 585, it is made in two ranges —20F to 220F and —40 to 160F. —Pacific Transducer Corp, 11836 W Pico Blvd, Los Angeles 64, Cal.

Speaker for use with MOTRAC two-way radio enables users to hear messages even when hundreds of feet from vehicles. The 15-w unit has an 8-ft coil cord and mounting brackets for temporary mounting on the outside of the vehicle window.—Motorola, Inc, 4501 W Augusta Blvd, Chicago 51, Ill.

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

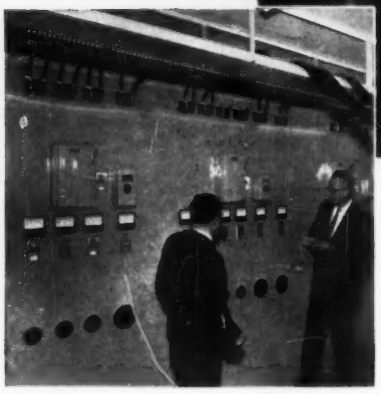
Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA
STEEL & WIRE CO., INC., Muncie, Indiana

Blackburn's

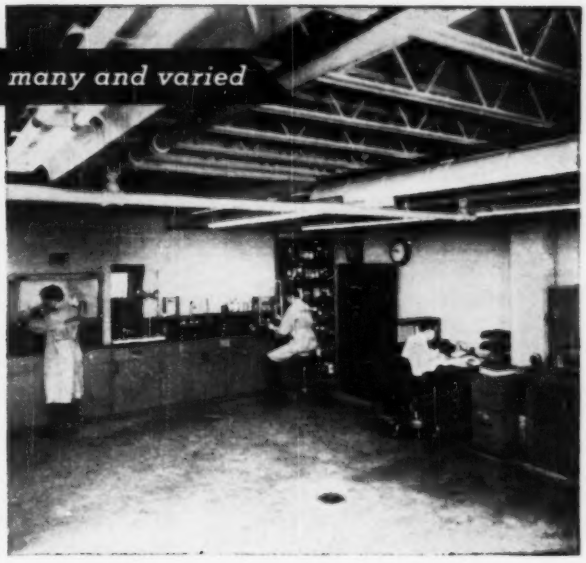
New Testing Facilities

give accurate test data for utilities, precise evaluation of design ideas



PART OF THE CONTROL PANEL of Blackburn's recently completed current cycling laboratory. John A. Toedtman, Chief Engineer (left), and Ken Way, Vice President, observe tests in progress.

NEW CURRENT CYCLING LABORATORY features virtually draftless air conditioning and a means of closely controlling ambient temperatures throughout the test area. Control of these factors permits truly precision testing of connectors. This photo shows Blackburn laboratory technicians taking resistance and temperature measurements of test connections. These new facilities permit testing of more than 500 connectors simultaneously. Advanced testing facilities like these enable Blackburn to provide you with the proper fitting for every operating condition.



THE GENERAL LABORATORY, a portion of which is shown here, is the scene of a great variety of tests. Hardness, yield and breaking strength of parts such as castings, bolts, etc., are determined. Special equipment is available for pull-out or holding force evaluation of all fittings. Clamping force measurements giving the relationship between tightening torque and the force exerted by the connector on the conductor are made here. Microscopic examinations and special electrical resistance measurements are routine. Tests like these give Blackburn fittings great dependability.

THE CHEMICAL LABORATORY is the center for tests to control various chemical process solutions used in production. Electroplating, etching, and metal cleaning solutions are regularly tested here. In addition, special surface treatments are evaluated for friction control and corrosion protection. Thus, this laboratory assures continuous control of quality.

SALT FOG CHAMBER, where tests may continue for hundreds or even thousands of hours. Here salt fog tests are made on wire connections. Test conditions are made in accordance with ASTM specifications. Electrical resistance measurements and visual observations are recorded at regular intervals during the tests.

OUTDOOR EXPOSURE RACKS permit long-term exposure tests which often yield valuable information on weathering resistance not accurately obtainable from more highly accelerated tests. Specimens on these racks generally remain on test for at least a ten-year period.

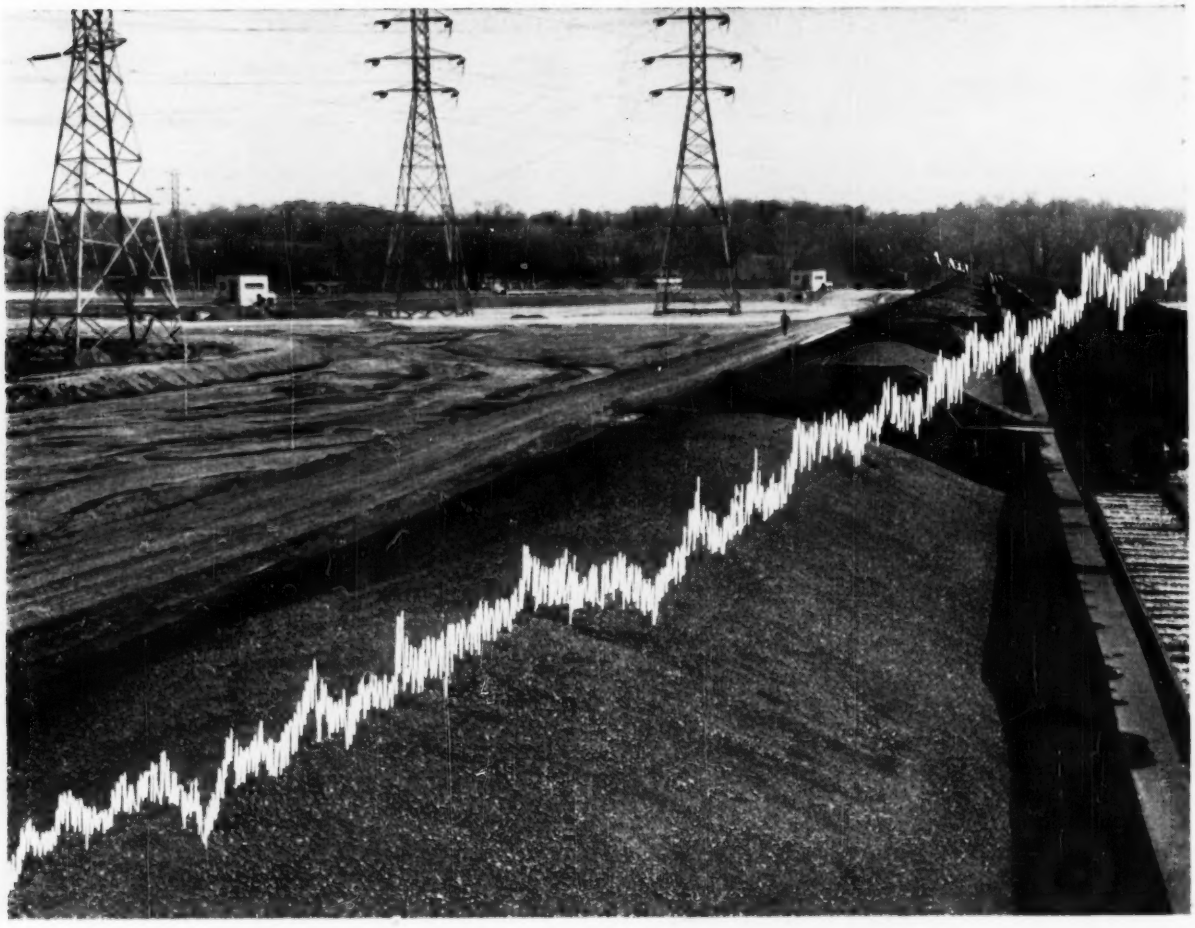
Look to BLACKBURN for *test-engineered* electrical fittings

JASPER BLACKBURN CORPORATION

1525 Woodson Rd. • St. Louis 14, Mo. • WYdown 3-9430

it is reassuring to utilities,

as they project the demand for power in their areas in the decades ahead . . . to know that career coal companies like Island Creek stand ready to deliver all the coal they will need. Island Creek's vast reserves,* modern mining methods and scientific preparation assure continuity of supply far into the future. Our engineers would welcome an opportunity to talk with yours.

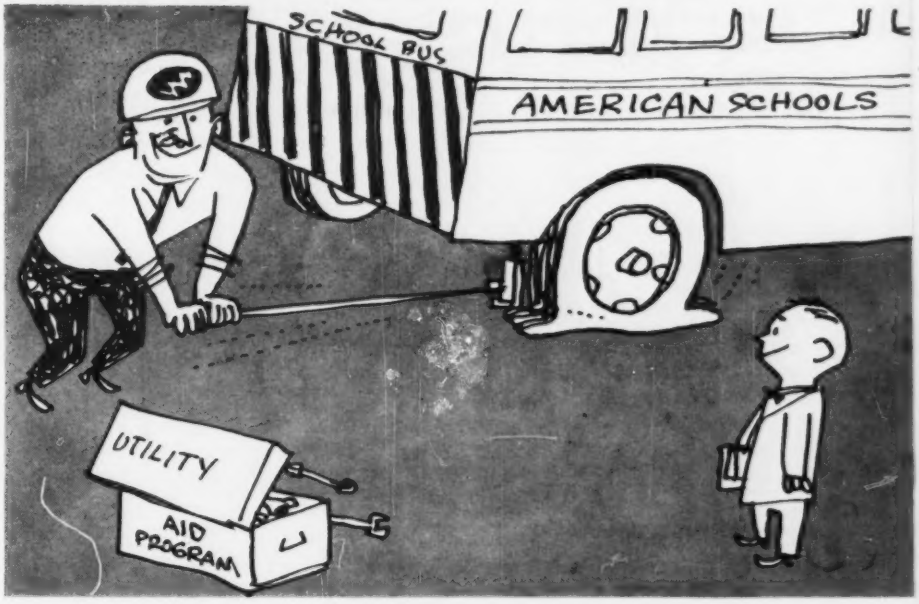


Island Creek's vast, proven, available reserves total more today than Island Creek has taken out of the earth in the past 50 years.

You can depend on **ISLAND CREEK**

. . . a career company . . . dedicated to coal

Island Creek Coal Sales Company, Chafin Building, Huntington 18, West Va. • Cincinnati • Cleveland • Greensboro • Chicago • Detroit • New York • Pittsburgh



How to Help Your Local Schools

Report on
Aid to Education

The utility industry can make an important contribution to local education. Edison Electric Institute's Committee on Relations with Educational Institutions has found that many power companies are already lending their local schools a helping hand, and many more are interested in doing so. But when it comes down to setting up the aid activity, the committee found, the utilities are not always so sure just how to go about it. For this reason, EEI checked with a number of companies with successful and worthwhile educational activities and with the National Education Association. The result is a booklet, just published, which lays out some guide lines for a utility to follow in aiding local education. Copies are available from EEI at 75¢ a single copy.

The utilities realize they have much at stake in education. The school children of today are the customers, employees, and community officials of tomorrow. It is in the junior and senior high schools that the groundwork for a future scientific or engineering education is laid; and if it is laid poorly, many who have the aptitude to be engineers will be uninterested or unqualified when they reach college. An even more basic reason why utilities are concerned about education is that they want to be good citizens of the communities they serve, and there is no more pressing local problem today than education.

Helping education is not so simple as it might seem, however. The EEI committee points out that there are several important things to remember when making an offer of aid. For one thing, educators jealously guard their prerogatives as the trustees of the minds of youth. Under no circumstances are they interested in any form of aid that infringes on these prerogatives. Dr Frank W. Hubbard, assistant executive secretary for information services for NEA, declares:

"We are ready to reach out and touch hands with any group that wants to approach this problem of getting together, so that the schools are gaining in knowledge and information and procedures and processes that can be used in instruction. We will reach out as long as we can do it under conditions that are

STUDY THE LOCAL SITUATION
OUR LOCAL SCHOOLS
LET THE SCHOOL OFFICIALS SET POLICY
AREA OF NEED
WORK AS PART OF A GROUP
JOBS TO DO
ORGANIZE YOUR AID ACTIVITIES
BLUE PRINT OF EDUCATION AID

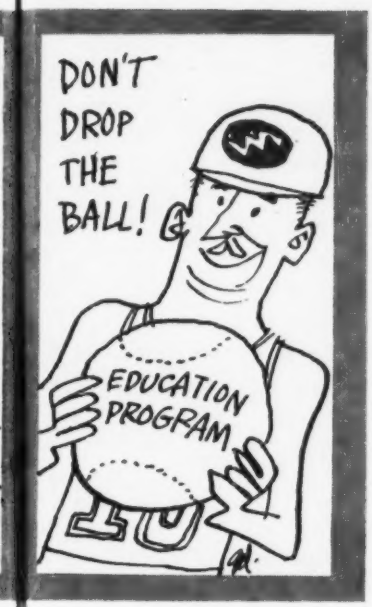
acceptable in terms of educational theory and practice, as long as we are not exploiting the children or exploiting the teachers or exploiting our school system." In order to avoid conflicts, EEI suggests a number of rules to follow.

The first step is to find out about the local school situation. Although it could be said that all the schools have many problems, they do not all have the same ones. The American system of education is a very intricate structure. Our schools are controlled by the states and even more by the communities they serve; and because of this they tend to reflect quite closely the needs and desires of their local areas. A high school in one town is different from the high school 100 miles away, and it must be treated differently. Also, an elementary school obviously requires a different type of aid program than that required by a senior high school or a college. The point is that educational aid must be tailored to suit its beneficiary. Knowing and understanding the educational system in the community is the first step toward developing a sound educational aid program.

Remember that educators set school policy, and no amount of educational aid gives business the right to usurp this function. It is important to remember to start any discussion of aid with the superintendent of schools. He is the man who deals with policy matters, and he can give the best picture of the needs of the school system. He will also know best which of these needs can be supplied by any specific program which your company might have in mind. Don't try to tell the superintendent of schools what he or his schools should be doing. The first aim should be to find out how the school reacts to your offer and how your company can be of the most help.

Under no circumstances try to use the schools as a propaganda platform. The superintendent has a responsibility to keep out of the schools anything that smacks of propaganda or commercialism. Once he is convinced that your company sincerely wants to help the schools and is willing to observe the rules of school management, the superintendent will be glad to get down to details, and help you develop a program that will use the facilities your company has to offer education most efficiently.

One sort of aid conducted by many utilities is instruction in the applications of electricity. This does not fall under the heading of advertising, and most edu-



cators don't seem to think it does. Just as it is now general practice for the school to teach students to brush their teeth twice a day even though this instruction may involve the use of commercial products, so an ever growing number of schools has begun to teach children the basic facts of light and sight and how they can use electricity in other ways more safely, efficiently, and effectively. The decision, however, is up to the superintendent.

Bear in mind also that in some localities, this vigilance against propaganda will extend so far as to ban company personnel from appearing in the classroom at all. The superintendent may prefer to set up special training sessions for his own teachers, who would, in turn, teach the students themselves, rather than using outsiders. Ask the superintendent. The important thing to remember is that if a utility genuinely wishes to help local education, it must do so on the local educators' own terms and with no strings attached.

Work as part of a group of businesses, if possible. Before going all out on an educational aid program, it is a good idea to find out what other business groups in the community are doing to aid education, and to coordinate with them. Today many businesses are becoming aware of the importance of education and are doing their bit to help. This is desirable, of course, but it has a tendency to crowd the field. Some checking is in order so as to insure that your company will not work at cross purposes with these other groups nor duplicate their activities. Generally the superintendent can tell you much about what other businesses are doing, but it is also wise to check with the businesses themselves.

These are some good reasons for this. For one thing, aid can take many forms, and no one company can do everything. Also, many school systems prefer cooperation to come from a group of companies rather than any one. This approach, they feel, tends to eliminate the commercialism and self-advertising they are so anxious to avoid. Of course, in communities where no cooperative activities exist, there is no reason why a utility cannot go ahead with a program that it can work out with the school system.

Organize your own educational aid activities, too. In the past, EEI found such activities carried on by electric companies have often been hit-or-miss propositions, with many parts of the company contributing, but with little co-ordination between them. A large company should appoint a full-time coordinator to work with school officials and members of the company. It is his business to know what various departments of his company can offer, what the schools need, and to match them up whenever possible.

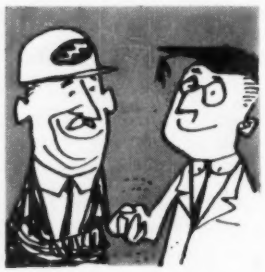
Since the initial dealings will be with the top people in the school system, it is best for them to be conducted by members of the utility's own top echelon. Once basic policy has been established, however, the coordinator should have the responsibility and the authority to develop and conduct the program.

Finally, if you are going to start a program to aid education, keep it up. Don't begin to help, and then drop the ball. The successful educational aid program is the one that the schools know they can count on year after year. For this reason it is well to take the time at the beginning to plan for the future. Of course, any such program will evolve with time; and regular meetings between the coordinator and the school officials will be required to keep it up to date. But do not allow your activity to cease after the initial enthusiasm wears off. EEI's pamphlet points out: "Sporadic activities and sudden bursts of cooperative activity that are as suddenly withdrawn will have little real value either to the schools or to the company."

There are many ways for utilities to aid local schools. Twenty-three examples of proven worth are listed on the next page. The important thing, however, is not the quantity of projects but the quality of the effort, EEI notes. For example, a well-organized and well-conducted plant tour can be extremely informative;

mishandled, it can leave only the impression of disorganized confusion. It is necessary to do these projects well or not at all.

One maxim applies no matter what form your aid program takes: "Remember that your company is entering the field of educational aid primarily to help the schools," EEI says. "Its aim is to benefit the students. A program designed with the schools' and the students' best interests in mind will generate good will in the community as well as help to insure the training of the kind of personnel your company will need in the future."



Here Are 23 Ways Utilities Can Help Local Education

1. Making trained company personnel available for vocational guidance conferences and forums.
2. Publishing pamphlets describing career opportunities in the electric utility industry.
3. Cooperating with the schools in preparation of special exhibits relating the company, the power industry, or scientific matters.
4. Employing students under the cooperative education plan, in which qualified students spend a part of their school day working in jobs related directly to their studies.
5. Employing students in summer to give them a practical view of future career opportunities and also an opportunity to earn additional income which may help them to continue in school.
6. Employing teachers during the summer to keep them in touch with current methods and practices, as well as to let them add to their incomes.
7. Taking part in Business-Industry-Education days, in which schools visit companies' plants.
8. Taking part in Education-Business-Industry days, in which business visits the schools.
9. Arranging plant tours for students and teachers.
10. Preparing publications on the nature and applications of electricity for use by the schools.
11. Preparing or providing films for school use.
12. Placing the company reference library or other research facilities maintained by the company at the disposal of teachers and students.
13. Maintaining a speakers' bureau to give supplementary lectures in the schools on such subjects as the nature of electricity, atomic power development, and the electric industry.
14. Encouraging employees to take an active part in local school affairs.
15. Giving employees time off to participate in special community school affairs.
16. Lending personnel to help state or local committees working to improve the school system.
17. Helping the schools obtain voter support for needed bond issues.
18. Preparing or sponsoring public service advertising on behalf of the schools, either at the national or the local level.
19. Participating in teacher recognition days or similar activities which honor the teacher's role in the community.
20. Contributing equipment or demonstration materials for use in classrooms.
21. Giving special awards to students for achievements in mathematics or the sciences.
22. Giving scholarships and fellowships to outstanding students and teachers for further study.
23. Becoming active individually in school affairs.

MEDALLION HOMES are featured at House & Home Style Center in Illinois. Homes will be sold later, jacked up, and moved to owners' property

Utilities, Builders Favor Medallion Homes

Medallion Homes are finding as much favor as ever with builders and utilities throughout the nation. Two recent developments reported below are evidence of this.

A Medallion Home promotion staged by Illinois Power Co during National Home Week may have been the most successful campaign ever put on by that utility. At least that's what company officials and participating dealers say.

"Our program . . . was probably the most successful we have ever staged in any of the territory we serve," according to H. D. Hewey, advertising manager of Illinois Power.

Builder reaction was unanimous in praise of the utility's promotion.

"This promotion to us was the finest thing that a utility company has ever put on and we can directly attribute at least five home sales to this campaign," Joe E. Frank, vice president, Community Homes, Inc, said.

"The cooperation of all the participating merchants, and the excellent promotional job by the Illinois Power Co, made this one of the most outstanding promotions we have ever staged. We have had many excellent leads from the style center opening and anticipate that a major portion of these will be turned into sales," Clarence A. Thompson, president, Thompson Lumber Co., reported.

The promotion, staged in the utility's Champaign-Urbana area to coordinate with National Home Week, began with a meeting in the Decatur headquarters. Plans were drawn up to contact prospective builders and explain IPCO's participation in the Week. Company officials were successful in interesting one builder to construct a home in the $65,000 class, a second builder in the $18,000 range, and others to build in the $12,000 to $25,000 classes.

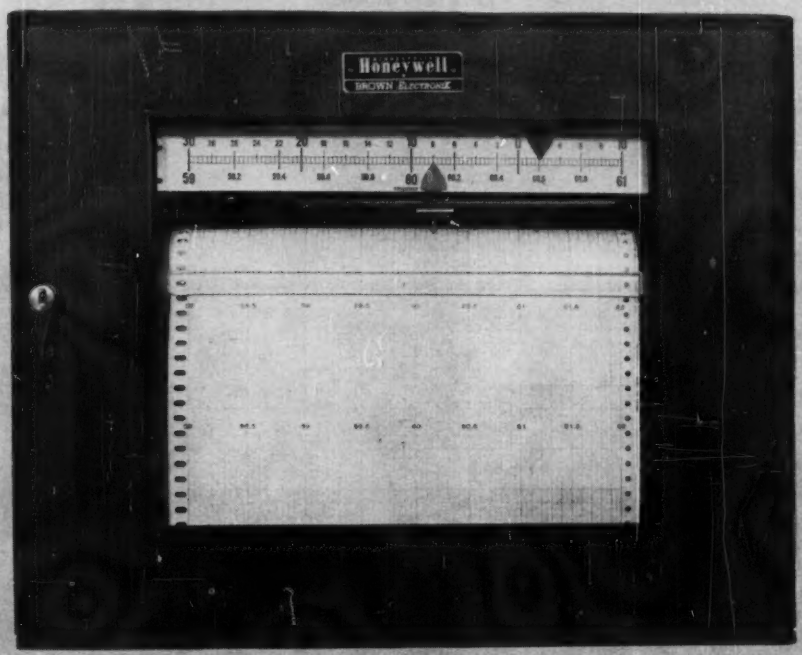
Thompson House & Home Style Center, which had three homes, was scheduled to open in August, but the power company persuaded the builder to hold the opening during National Home Week. J. F. Maline and Mrs. Clara Gentille of Illinois Power worked out the wiring, lighting and electric heat for the homes, two of which were Gold Medallion. One was a Bronze.

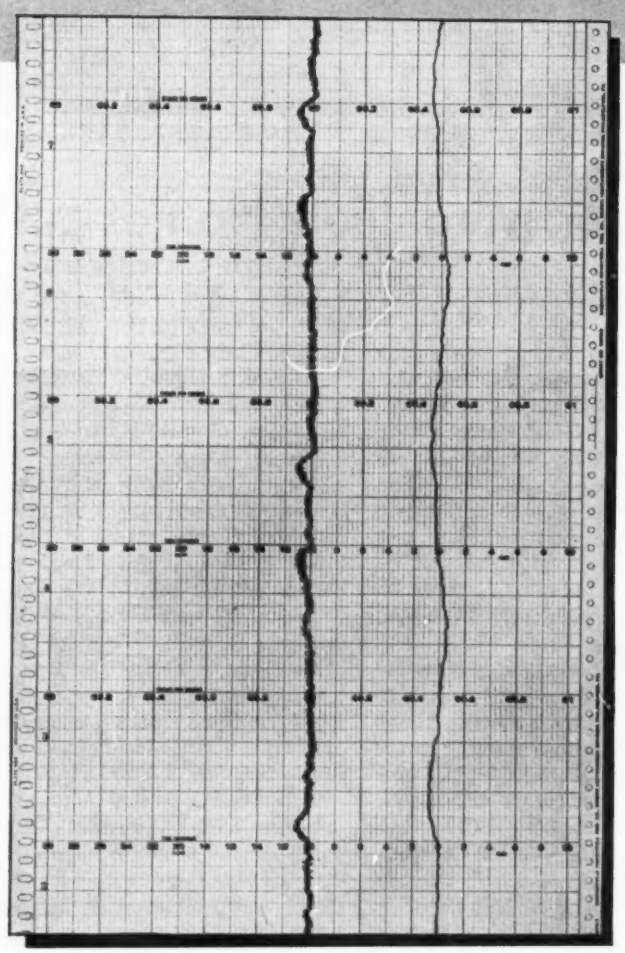
Next, the company called on interested dealers to arrange a meeting of all participating companies and explain the Medallion promotion.

A Medallion Queen Contest was devised. The 700-member Champaign-Urbana Junior Women's Club was asked to select a Medallion Queen and court from its members.

(*Continued on page* 130)

***ElectroniK* time deviation recorder** has an accuracy of ¼ percent and sensitivity of ½ percent. Standard ranges are 10-0-10 and 30-0-10 seconds, on the full 10½" width of the calibrated chart.



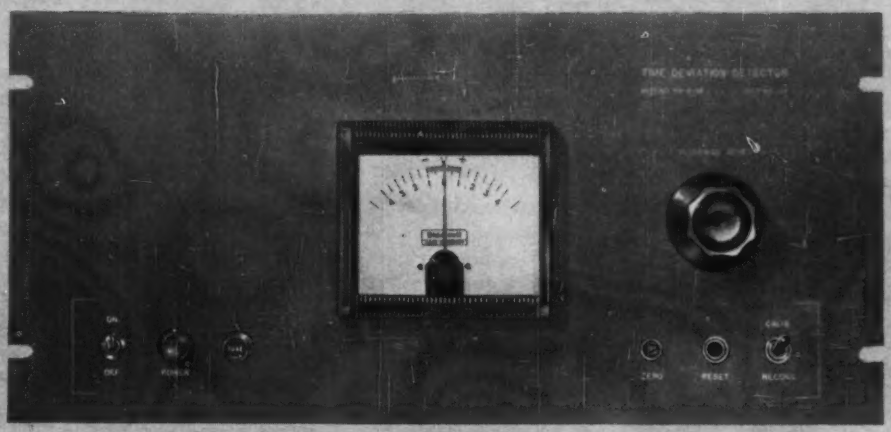


ElectroniK

aids in

Record of frequency and time deviation on same chart. Full chart width is used for both calibrations.

75th YEAR
PIONEERING THE FUTURE



Time Deviation Detector uses highly accurate synchro as a differential error detector between line frequency and a standard frequency. Overall accuracy will depend on that of the frequency standard used which can be 1 part in 1,000,000. A retransmitting slide wire transmits to the recorder. Unit is housed or rack mounted in a standard 19" relay rack.

time deviation recorder

maintaining correct time in your generating system

The *ElectroniK* Time Deviation Recorder provides an indication and a continuous chart record of time error due to frequency changes on your electrical generating system. It detects the difference between your system frequency and a standard frequency. It integrates frequency deviation from standard (60 cycles on a 60 cycle system) and duration of this deviation to produce a direct reading chart in seconds of time, slow or fast.

Using the *ElectroniK* chart record as a guide, the operator or load dispatcher can easily make up lost time during off peak periods thereby reducing his time error to zero (correct time).

The instrument is available with automatic control features and fits nicely in Load-Frequency Control Systems to maintain correct time automatically.

Your nearby Honeywell field engineer can give you complete details on this and other instrumentation for central station use. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Phila. 44, Pa.

Honeywell

First in Control

SINCE 1885

Medallion Homes

(*Continued from page* 127)

Suppliers were asked to furnish wiring, lighting, heating and air conditioning for the Medallion Homes.

Newspapers were contacted to help with publicity, picture coverage and, placing stories. Papers offered supplements to help promote the activity.

On Sunday, Sept. 13, both participating newspapers broke with a supplement containing picture and news stories inviting people in the area to visit Medallion Homes on display. Several thousand turned out.

On Friday, Sept. 18, the Queen and her court paraded from Illinois Power's downtown office to the Style Center courtyard where the queen was crowned, "Mrs. Medallion Home." On the following Saturday, and Sunday, the queen and her court made appearances at all participating homes.

"The response we received from participating dealers was extremely gratifying," Hewey says. "We had the cooperation of the mayor, many celebrities, and the Chamber of Commerce officials to make this promotion, in our opinion, one of Champaign-Urbana's most outstanding events."

SoCalEd Runs Big Promotion

What is reportedly the largest single Medallion Home contract in the nation, 1,350 homes, figures in the latest MH promotion at Southern California Edison Co. The housing development will be built on the part of the Joel McCrea ranch recently acquired by Conejo Valley Development Co, builders of the project.

Asked why he decided on an all-Medallion development, Harris P. Goldberg, president of the company, said, "Because my experience has proved that Medallion Homes sell three times as fast as other homes."

Goldberg's Medallion Homes will be priced in the $15,000 class but will incorporate many "plus" features of more expensive homes. The all-electric kitchen, for instance, will have a built-in range and oven, hood-ventilator unit, and waste disposer. Each home will have an electric clothes dryer.

Sales aids devised by the utility for participating builders include:

- A four-page Medallion section in the Real Estate Section of a Los Angeles paper. The section was also mailed to prospective home buyers who mailed in coupons clipped from the Edison's Medallion Home advertisements.
- Full-page Medallion builder-participation ads, each carrying 24 separate builder ads with directional maps.
- Medallion telephone information service, where prospective home buyers could get locations of builders of Medallion homes. All people who phoned in were also sent a copy of the 4-page Medallion spread; a booklet, "What a Medallion Home Means to You;" and a complete list of Medallion builders, arranged geographically.
- Advertising back-up such as radio advertising, billboards and point-of-purchase material.

In another MH move at Southern California Edison, a Gold Medallion Home was a featured attraction at the Los Angeles County Fair recently.

T. M. McDaniel, Jr, Edison vice president, described the home as a "small house with big ideas" since it combines functional efficiency with numerous comfort-plus features.

Kitchen appliances include a push-button range top, large oven, top-loading dishwasher, ceramic broiler for indoor barbecuing, a 40-gal water heater, refrigerator-freezer, and properly placed electric convenience outlets. Year-round climate control is provided with an electric heat pump.

"The Compact House," as it is called, represents an attempt to meet the needs of an increasing number of people who do not want large, sprawling houses, McDaniel said.

SoCalEd led the nation last year in the number of Medallion Homes signed up.

New York May Require Building Front Lighting

New York City may require its property owners to light their building fronts. This was proposed in a bill introduced to the City Council Dec. 15.

The proposal was introduced to help fight crime, as many areas of the city are too dark for policemen to see down the whole block, according to Majority Leader Joseph T. Sharkey, sponsor of the bill.

"The lighting shall be equivalent to that which would be provided by one 60-w incandescent light for every 50 ft of street frontage, or part thereof," the bill states.

Bulbs would be turned on one hour after sunset and left on until an hour before sunrise.

The bill has been referred to the City Council's Committee on Buildings. If passed, the Commissioner of Water Supply, Gas & Electricity will be empowered to rule on location, shielding, number, intensity and kind of lighting.

Perked-up Interest Shown In Light-for-Living

Perked-up interest by allies and utilities in the "Light-for-Living Contest" has been reported by Edison Electric Institute.

Nearly 1½-million entry booklets have been ordered by 145 utilities. Booklets have also been sent to manufacturers, associations, REA's and municipals.

Sales of 6,500 display kits and 3,500 "Day-glo" display kits have been reported by EEI. The group figures that at least 10,000 dealer outlets are now distributing entry booklets.

Heat Pump Helps Increase Milk Production

Using a heat pump-grass producing incubator to grow oats for cattle, an Alabama dairy farmer learned, increased milk production.

Alabama Power Co "Powergrams" has found that T. L. Crowder, owner of a farm near Eclectic, uses his heat pump to grow oats instead of grass. He has discovered his cows produce many more pounds of milk per day since he feeds the green oats—roots and tops — from the pump-incubator. This answers the problem of achieving a high milk output from the herd the year 'round instead of having high production peaks in the spring and a slump in the fall and winter.

"Chance Individually Packaged Clamps will give us better connections . . . automatically"

CC59-28

All Chance Hot Tap Clamps, Parallel Groove Clamps, Uniclamps, U-Bolt Clamps and Bail Clamps are available in individual plastic bags.

This observation is *typical* of the man responsible for line connections . . .

He knows that contact surfaces must be clean, and protected with an electrical contact aid to inhibit corrosion, maintain effective conductivity, prevent burndowns. He also knows how difficult it is to get linemen to take any extra steps when making a connection.

Chance Individually Packaged Clamps come to you in polyethylene bags with z.l.n. 100 Contact Aid factory-applied to the contact area. Linemen are spared those "extra steps"—they make better connections automatically. And, printed on the sealing tape of each package, there is a reminder to clean and coat the conductor. Supervision is simplified. Incidentally, linemen needn't remove their gloves to get at the clamp. They cut open the bag with sidecutters, and just slip it off the clamp.

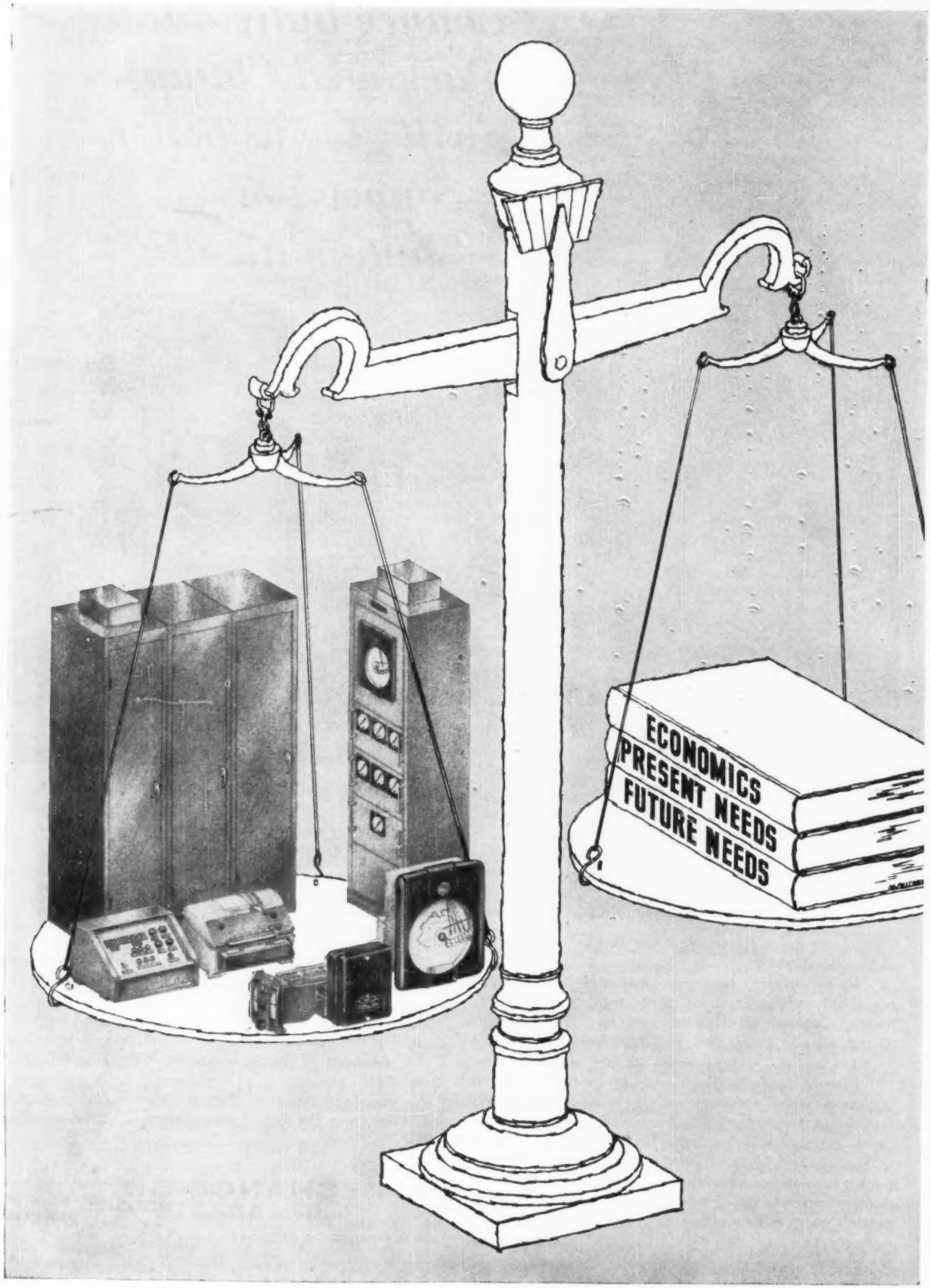
When your crews use Chance Individually Packaged Clamps, you know a contact aid is being used on every connection, every time. Better, lasting connections are certain. z.l.n. 100 won't deteriorate . . . won't freeze, melt, run out, dry up, or wash away. Precoating protects when clamps are stored, too . . . ends the problem of in-stock contamination of contact surfaces.

So, standardize on Chance Individually Packaged Clamps, and get better connections . . . automatically.

A. B. CHANCE CO.

Centralia, Missouri

A. B. Chance Co. of Canada, Ltd., Toronto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PRESENT NEEDS
FUTURE NEEDS

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BALANCES ALL THESE FACTORS TO HELP YOU REACH OPTIMUM PERFORMANCE

Bailey takes a sensible systems approach by analyzing the immediate and future needs as well as the control economics of your complete process.

Backed by 40 years' experience in the field of measurement and control, Bailey engineers can insure that your system will have the proper balance both as to economics and needs . . . that there will not be the unnecessary expense of over-instrumentation or control . . . nor the duplication of equipment functions.

To effect this approach, Bailey offers a complete line of process and power system components:

Equipment—Primary sensing devices, indicators, recorders, loggers, control units, panels, data-handling equipment and computers for performance analysis, and supervisory controls.

State-of-the-Art—Conventional and sophisticated designs ranging from mechanical, pneumatic and electric thru electronic and solid-state.

Because all of these components are *standardized and compatible*, you have building block flexibility. You can add to your system as the need arises for more control or analysis.

Our complete line gives you one-source buying . . . one responsibility . . . qualified systems engineering . . . fast service . . . experienced field assistance on one instrument or on a complete system. Call our nearest office or write for information today.

G150-2

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Instruments and controls for power and process

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In Canada—Bailey Meter Company Limited, Montreal

Arkansas P&L Elects Walsh a Vice President

Arkansas Power & Light Co has elected Carroll H. Walsh a vice-president. He is the chief engineer.

Walsh began his power company career in 1927 as an assistant engineer. In 1938, he was promoted to electrical engineer, then assistant chief engineer in 1956, and chief engineer in 1958. Before joining the power company he worked for the Crossett Lumber Co, Ford, Bacon & Davis, an engineering firm, and the Missouri Pacific Railroad.

He will continue to be responsible for the engineering and other activities now under his supervision.

A member of the American Institute of Electrical Engineers, he is also a member of the American Society of Professional Engineers, and of Tau Beta Pi, honorary engineering fraternity.

His son, John Glenn, is with the Union Electric Co, St. Louis, Mo.

Bosanko Named to New VP Post at I-T-E Circuit Breaker

Alfred G. Bosanko has been named to the newly created post of vice president, indoor distribution, at the I-T-E Circuit Breaker Co. In his new position, he will be responsible for the over-all operations of I-T-E divisions and subsidiaries which produce indoor distribution products.

Bosanko has been in the electrical industry for over 35 years. He had been president of the Walker Electrical Co, an I-T-E subsidiary.

Before that he was associated with the engineering departments of the Empire Switchboard Co, and the Royal Switchboard Co.

He has been a director of I-T-E since February, 1957.

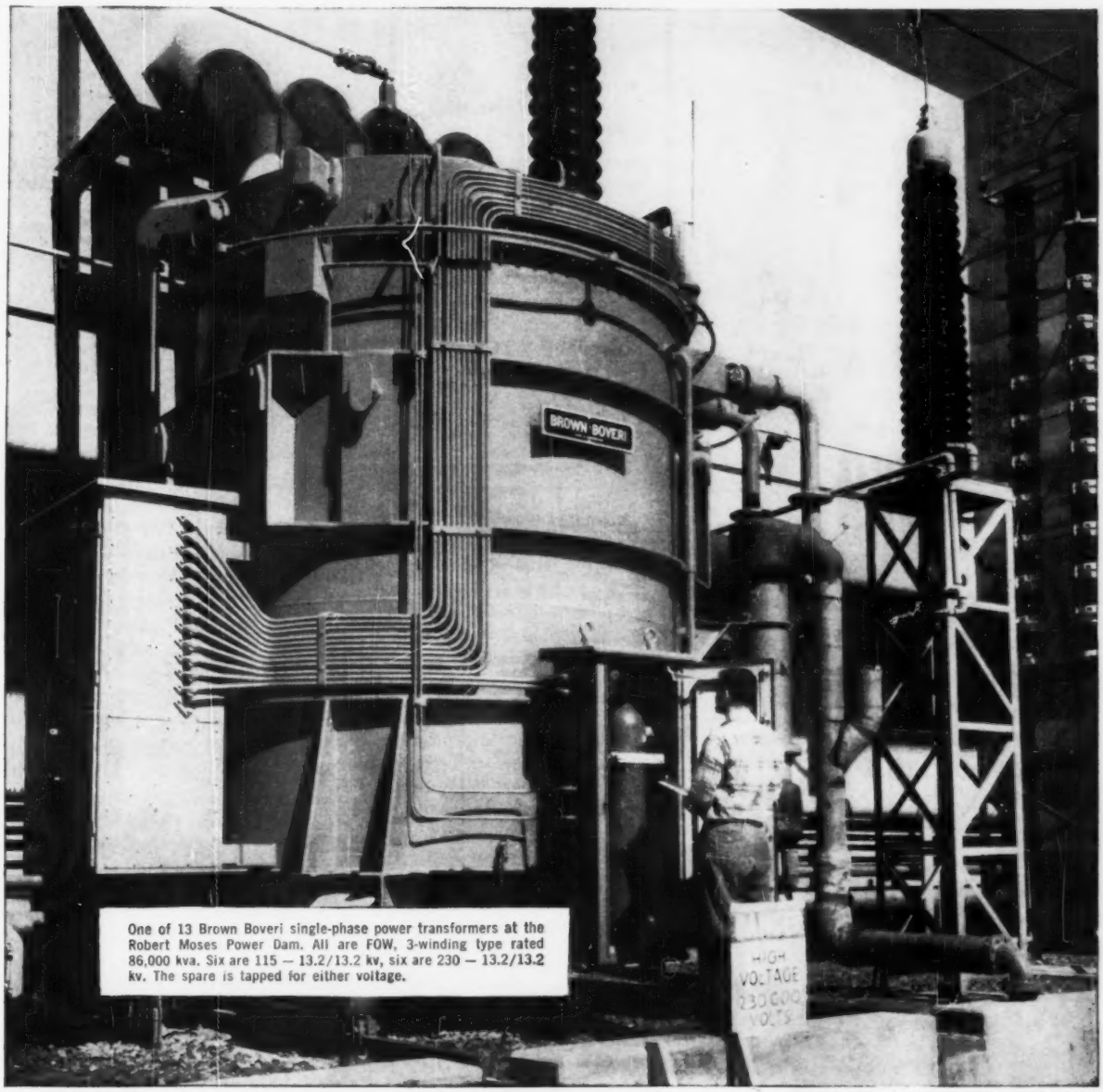
Oakes Made a Vice President at Square D Co

Square D Co has made T. R. Oakes vice president and secretary. This makes him chief financial and accounting officer of the company. Henry Morgan, formerly vice president-finance and secretary, will continue as a vice president and director.

Oakes joined Square D as treasurer in 1955. Previous to that, he served as treasurer and director of Houdaille-Hershey Corp, Detroit.

Morgan, who has been with Square D since 1928, will serve in a consultant capacity with offices in Detroit, when the company moves to its new executive offices in Park Ridge, Ill.

(*More News About People on page* 136)



One of 13 Brown Boveri single-phase power transformers at the Robert Moses Power Dam. All are FOW, 3-winding type rated 86,000 kva. Six are 115 — 13.2/13.2 kv, six are 230 — 13.2/13.2 kv. The spare is tapped for either voltage.

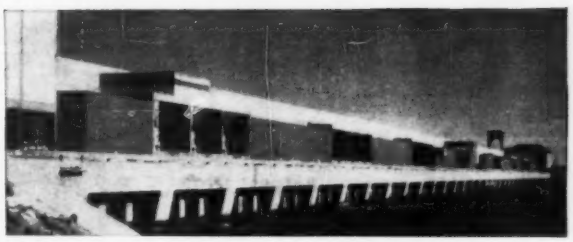
PHOTOS COURTESY OF N. Y. STATE POWER AUTHORITY

ALL'S QUIET AT MASSENA

You've heard the experts say it: Low noise means good design, tight construction. We agree. It's worth a trip to Massena just to hear the quiet around these Brown Boveri transformers.

Other features that can't be heard: the compact size, the light weight per kva, the high efficiency, the reliable service facilities . . . and the substantial dollar savings for a cost-conscious power producer.

Many of these features are due to Brown Boveri's exclusive radially laminated core. We'll be glad to give you full information about this core design and other features of Brown Boveri power transformers.



The Moses-Saunders Power Dam near Massena, N. Y., second largest hydro plant in the U. S. It was constructed jointly by the Power Authority of the State of New York and The Hydro-Electric Power Commission of Ontario.

BROWN BOVERI Brown Boveri Corp., Dept. EW12, 19 Rector Street, New York 6, N.Y. Agents in 27 U.S. cities

I wish we had more time
and personnel to prepare
for this rate case!

Your staff is
overloaded now.
Call in the specialists and
let them carry the peak load.
HOW ABOUT PIONEER?

GIVE YOUR NON-ROUTINE
OPERATIONS TO PIONEER

Design and Consulting Engineering Services

Pioneer has specialized in designing power plants for 57 years. It designs fossil fuel, hydro and atomic plants. It forecasts load growth, selects sites, purchases and expedites equipment and supervises construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters

Pioneer offers services in all phases of Federal, State and Local regulation including rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services

Pioneer's services in corporate matters include business and management engineering advice, financial, accounting, tax counsel, insurance, and pension planning. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!

On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes, illustrates Pioneer's engineering services, and corporate services, from financing to operation.

57 YEARS

Pioneer Service
& Engineering Co.

231 South La Salle Street
Chicago 4, Illinois

Connell Named Purchasing Agent at B&W Division

J. R. Connell has been named purchasing agent of Babcock & Wilcox Co's Boiler Division. Connell, who joined the company in the purchasing department at the Alliance, Ohio, Keystone Plant in 1942, has been acting division purchasing agent since last December.

In between times, he spent nine years with the United States Steel Corp, was assistant purchasing agent of B&W's Tubular Products Division from 1949 to 1954, and assistant general purchasing agent in Barberton from 1954 to last December.

PERSONAL BRIEFS

Czar Langston Jr has been chosen to manage Oklahoma Assn of Electric Cooperatives. He succeeds **Floyd Gibson.**

Ebasco Services Inc has made the following additions to its management consulting staff: **Carl E. Anderson,** general management consultant; **Harold P. Richmond,** general gas consultant; **Paul L. Gill,** director of industrial planning; **Clinton J. Sammond,** management consultant in Dallas; and **Raymond M. Holmes,** management consulting supervisor at Ebasco's Washington, D. C., office.

Atlantic City Electric Co has named **Benjamin H. Cheeseman** to succeed **Richard W. Russell Sr** as

assistant plant superintendent at Deepwater Station. Other changes at ACE were as follows: **Douglas C. Rogers** became operations supervisor; **Walter M. Turner**, Missouri Ave. plant superintendent, retired; **Byron C. Haskell** has been appointed superintendent of Production; **Anthony May** has been made Missouri Ave. plant supervisor.

J. A. Moore has been promoted to the position of manager of Cabin Creek plant of Appalachian Power Co.

Harry Hale has been named superintendent of Ohio Edison Co's Toronto, Ohio, plant.

Toledo Edison Co has elected **Carl S. Fuller** to succeed **Ralph E. Carpenter** as a director. **John P. Williamson** has become assistant treasurer.

James M. Stuart, president of Dayton Power & Light Co, has been awarded honorary membership in Dayton University's Delta Nu chapter of Alpha Kappa Psi, professional business fraternity.

Duke Power Co has made the following staff changes: **James W. Foster** has been named supervisor of distribution engineering; **Henry L. Cranford** has become supervisor of rural extensions, succeeding **R. H. Woods Jr** who retired; **J. J. Strickland,** electrical engineer, has retired; **P. D. Huff** has been named assistant manager of distribution engineering.

Ohio Power has made **Clyde W. Kirkland** local manager at Pomeroy, succeeding **Ronald L. Springer.**

A. L. Maxwell has been appointed manager of taxes for Southern California Edison Co, succeeding **Smith B. Davis.**

Thomas A. Donoghue, a meterman in the electric distribution department of the Public Service Electric & Gas Co, has been presented the President's Medal of the National Safety Council.

Indian. Michigan Electric Co has promot **Milton T. Roe** from manager of Hartford City, Ind., offices to division staff assistant at Dree Creek, Marion, Ind. **John P. Klee-**

HOT SPOT in your plant!

Guard spray booths, dip tanks, record vaults against the danger of fire! Guard them 24 hours a day with a Kidde fully-automatic carbon dioxide fire extinguishing system. Finest fire protection on the market today, Kidde systems give you these outstanding features that come from more than thirty-five years' experience!

All operating parts completely enclosed to guard against fouling or accidental operation.

No clumsy triggering methods or falling weights.

Self-contained; no outside power needed.

Visual indicators to show if system has been operated.

Easy testing of all operating parts.

No parts to replace after operation or test.

Fast-acting clean carbon dioxide does the job that no other extinguishing agent can do: snuffs fire out in seconds, then vanishes into thin air. Won't harm valuable machinery, leaves no mess to clean up. Write for Kidde's pressure operated carbon dioxide fire extinguishing systems booklet today.

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. . . to control water level at Long Sault Dam, St. Lawrence Power Project

MURCO GATE HOISTS

For the second largest hydroelectric power plant in the United States at Massena, New York—as part of the St. Lawrence power project—Uhl, Hall & Rich, project engineers, selected MURCO Gate Hoists to control the water level at Long Sault Dam. MURCO Gate Hoists are designed from knowledge and experience . . . backed by over 75 years in design and manufacture . . . made for any size power dam . . . capacities from less than 1 ton to over 100 tons . . . from the smallest hand operated to the largest motor operated gate hoist, all made to specifications.

Illustrated is one of the eighteen MURCO Gate Hoists on the Long Sault Dam shown above. Each hoist weighs 93,000 lbs. . . . has 175 tons lifting capacity . . . will raise and lower the gates in the dam at a speed of 1 foot per minute. The overall length of each unit is 57 feet . . . 8½ feet wide and 12½ feet high. Write for complete information and Engineering Department recommendations.

Manufacturers Since 1883

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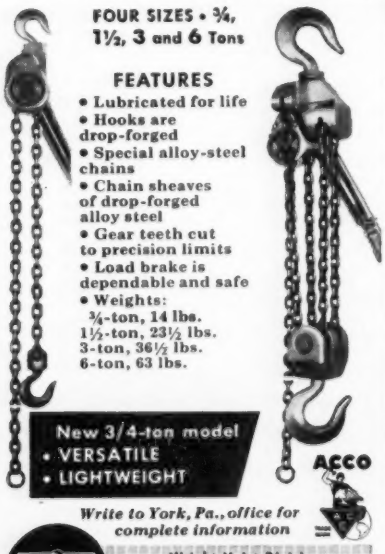
D. J. MURRAY MANUFACTURING CO.

WAUSAU, WISCONSIN

NEW ¾-ton Pull-A-Way

Added to WRIGHT TYPE "C" LINE!



FOUR SIZES • ¾, 1½, 3 and 6 Tons

FEATURES

- Lubricated for life
- Hooks are drop-forged
- Special alloy-steel chains
- Chain sheaves of drop-forged alloy steel
- Gear teeth cut to precision limits
- Load brake is dependable and safe
- Weights: ¾-ton, 14 lbs. 1½-ton, 23½ lbs. 3-ton, 36½ lbs. 6-ton, 63 lbs.

New 3/4-ton model
• VERSATILE
• LIGHTWEIGHT

ACCO

Write to York, Pa., office for complete information

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AMERICAN CHAIN & CABLE

York, Pa., Bridgeport, Conn.

To the man on the route slip . . .

. . . the $6 you save —Is it worth it?

- Stacks of dog-eared copies piling up on your desk . . .
- The risk of missing something you should know about today . . .

Your name, residence address, title, and company on a post card will bring 52 weekly issues of Electrical World directly to your home. You can pay the $6 later. Address: Electrical World, Dept H-2, 330 W. 42 St., New York 36, N. Y.

Whether a Winch Line Hook or a complete Line Body check your requirements with

UTILITY TOOL & BODY CO.

CLINTONVILLE, WISCONSIN

UT&BCo

fisch has succeeded Roe at Hartford City.

3E Co, Hubbard Co subsidiary, has appointed **Paul H. Coleman** director of manufacturing.

B. P. Montagriff, industrial sales engineer for Public Service Co of Colorado, has been chosen to succeed retiring **Ralph B. Hubbard** as manager of the Rocky Mountain Electrical League.

Allis-Chalmers Mfg Co has named **Thomas A. Humann** territory sales manager of Northern Latin America.

Willard C. Brown, manager of lighting education for General Electric's Cleveland lamp department, has been named new president of the U. S. Committee of the International Commission on Illumination.

S. C. Rexinger, sales manager, electric housewares dept, Toastmaster Division, McGraw Edison Co, has been elected chairman of the electric housewares section of the National Electrical Manufacturers Assn. He succeeds **Arnold O. Wolf.**

Sylvania-Corning Nuclear Corp has appointed **Henry Holt Apgar** assistant manager of purchases. **John J. McCarthy** has become buyer for the firm.

Richard C. Scott has been named director of staff engineering for Dresser Electric Co.

OBITUARY

Walter J. Drury, 77, former vice president and Eastern district manager of the Graybar Electric Co . . . **George Gordon Gibson Sr,** 82, who retired as superintendent of electric distribution of Louisville Gas & Electric Co in 1942 . . . **William S. Breazeale Jr,** 65, recently retired as assistant division superintendent of Duke Power Substation . . . **E. H. Anson,** 56, senior vice president of Gibbs & Hill, Inc . . . **Glenn B. Miller,** 65, retired supervising engineer for Westinghouse Electric Corp.

SALES ASSIGNMENTS

COMPANY STAFFS

Ohio Brass Co has assigned District Manager Paul C. Lamont to its New York City office where he will handle a number of accounts formerly served by David H. Moore who has retired. Lamont will also be responsible for the area in New York state outside of New York City which he has covered since 1956.

Thor Power Tool Co appointed John L. MacDonald manager of the newly-created sales training department. James Q. Golden, Atlanta district sales manager, has been named MacDonald's successor as Philadelphia district sales manager. Other personnel changes include: Richard E. James, district manager in Indianapolis, Ind., replacing Golden at Atlanta; Samuel P. Gartland transfers from his position as Boston district manager to succeed James at Indianapolis, and Robert J. Grey becomes district sales manager at Boston.

Ward Leonard Electric Co has appointed Charles B. Durling as district manager of the Chicago office, succeeding Kline Gray who has retired. W. L. Patton has been made manager of the Pittsburgh office and Robert Peterson as St. Louis district manager.

REPRESENTATIVES

Macallen Enterprises, Inc, has been appointed U. S. agents for Osborne Electric Co, Ltd, Canada.

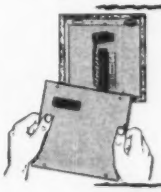
Electric Distribution Products, Inc, Allentown, Pa., has appointed the following new sales representatives: Gregory-Salisbury & Co, with offices in Louisiana, Mississippi, Tennessee, Alabama, and Arkansas; Robert S. Fishburne, Richmond, Va.; Powell Electrical Mfg Co, Houston, Texas; R. W. Chapman, Charlotte, N. C.; Webco, Inc, Detroit, Mich.; John M. Perry Co, Grand Rapids, Mich.; Baynes, Inc, Hartford, Conn.; South East Engineering Services, Inc, South Jacksonville, Fla.; D. H. Jones Associates, Jersey City, N. J.; Porter Electrical Mfg Co, Murraysville, Pa.; R. L. Browne Co, Shawnee, Kansas, and Chuck Koerner, St. Louis, Mo.

* GTC ... THE UNITIZED COMMUNICATION SYSTEM ...

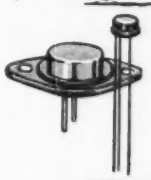
*an effective, economical industrial communication system designed to provide swift and sure voice communications regardless of distance or surrounding noise conditions.

COMPLETELY TRANSISTORIZED AND DESIGNED TO MEET THE CRITICAL REQUIREMENTS OF INDUSTRY

1. An effective, economical industrial communication system designed to provide swift and sure voice communication under adverse environmental conditions such as extremes of temperature and noise.



2. All amplifiers are "plug-in" contributing greatly to ease of installation and MAINTAINABILITY.



3. Transistors and rugged, industrial type components are used throughout. No vacuum tubes or "entertainment" type components of any kind are employed.

4. Central Control cabinet is eliminated thus reducing space requirement to a minimum.

5. ULTRA SIMPLE WIRING PLAN (no shielded cables) and UNITIZED EQUIPMENT with integral terminal facilities make for EASY LOW COST INSTALLATION and LATER EXPANSION.

* GAI-TRONICS TRANSISTORIZED COMMUNICATIONS

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ENGINEERS AND CONSULTANTS

GTC is extremely flexible in application. Write today for a copy of our completely illustrated, descriptive booklet and name of nearest representative.

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Galvanized

STEEL

For . .

• TRANSMISSION LINES

• DISTRIBUTION STATIONS

Is Custom-Made for Your Requirements by

• EXPERIENCED MEN

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STEEL IS AVAILABLE

Competitive Delivery Anywhere
Your inquiries are invited . . .

AISC

FLINT STEEL

TULSA, OKLA. MEMPHIS, TENN.

The Fifties

(*Continued from page 59*)

prehensive development of the Coosa River brought recognition to Alabama Power Co, and the three-dam plan for the Snake River signaled a victory for Idaho Power Co and the investor-owned segment of the industry.

In the distribution field Commonwealth Edison Co made one of the most significant advances in the use of buried cable for large residential areas. The decreasing gap between overhead and underground distribution costs has caused some companies to scrap old practices. Now it's becoming economically possible for more home owners to get underground service.

The March, 1958 sleet storm and other severe weather-caused outages have brought system-wide storm proofing of distribution facilities. Key factors here are the re-engineering and simplification of aerial cable and related plant that are cutting the cost differential between storm-proofed and standard systems.

U. S. transmission progress included the construction of 2,600 miles of lines 300 kv and higher since 1953. Major EHV research programs were undertaken, with General Electric Co's Pittsfield, Mass., and the Public Service Co of Colorado's high-altitude, Leadville, Colo., projects leading the way.

A revolution in accounting began with the introduction of electronic computers. Wisconsin Electric Power Co adopted an intermediate computor in 1955 and Commonwealth Edison brought an IBM 702 into customer accounting use the same year. The relatively recent application of computers on engineering problems was led by Detroit Edison Co and Public Service Electric & Gas of New Jersey. American Electric Power Service Corp pionneered the use of large computers for system studies.

In the fields of operation and construction, the application of power equipment and power tools stands out, as does the impetus to automated substations and hydro and steam plants. Use of aluminum in substations and low-alloy high-strength steel in towers also contributed significantly.

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Consulting Engineers
Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
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ASSOCIATES INC.
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ELECTRICAL TESTING LABORATORIES, INC.
Electrical, Electronic, Environmental, Photometric and Chemical Laboratories, Testing, Research, Inspection and Certification.
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HOOSIER ENGINEERING COMPANY
Erection and Maintenance of Electrical Transmission and Distribution Lines
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JENSEN, BOWEN & FARRELL
Engineers
Appraisals—Depreciation Studies—Property Records
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PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers . . Purchasing Specialists in Financing Accounting and other Operations
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SANBORN MAP COMPANY
Nation Wide Mapping Services
• Utility Area Base Maps
• Symbolized System Portrayal
Atlanta - New York - Chicago - San Francisco

SARGENT & LUNDY
Engineers
140 South Dearborn St.
Chicago, Ill.

TIPPETT & GEE
Consulting Engineers
Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process
1333 North Second Street Abilene, Texas

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EMPLOYMENT OPPORTUNITIES: $25.50 per inch, effective Jan., 1960. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.
BOX NUMBERS count as one time additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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POSITIONS VACANT

Electrical Engineer. Electrical Engineer with High Tension experience to manage Engineering Department for a manufacturer of Porcelain Insulators. Position includes full responsibility for design, testing and development of electrical porcelain. Replies confidential. P-2857, Electrical World.

Electrical Engineer. Board layout workpower, lighting, and control systems; calculations; and occasional field contacts. Extremely wide variety of work with opportunity to enter consulting field and grow with progressive midwestern concern. All replies will be answered. P-3222, Electrical World.

Electrical Engineers. Foreign Assignment. Utility experience required. Design and construction supervision of transmission and distribution lines, substations and equipment and rural electrification project. Mail experience record to: Miner and Miner, Consulting Engineers, Inc., 5598 South Broadway, Littleton, Colorado.

T & D Engineer—Young graduate electrical engineer with experience in transmission and distribution design and construction; supervisory ability; northern Maine utility; send complete resume and photograph. P-3255, Electrical World.

SELLING OPPORTUNITY AVAILABLE

Representative wanted for manufacturer of street lighting equipment pole line specialties. Full particulars. RW-9821, Electrical World.

WHEN

ANSWERING ADVERTISEMENTS

PLEASE *do not send original letters, certificates or photographs. We cannot be responsible for their return. Please send photostat or carbon copies.*

DEPRECIATION ENGINEER

A graduate engineer with experience in the gas or electric utility fields, with ability to apply generally accepted theories and methods for determining depreciation rates and reserves, is being sought by a major engineering-consulting firm. Under rules of taxation applicable to electric and gas utilities, he will be responsible for:

Determining depreciation allowances based on estimated useful lives and salvage; developing and applying mortality curves to mass property accounts as a statistical means of identification of property; developing statistical studies to measure reasonableness of reserves for depreciation.

Please send complete confidential resume to:

Box P-3305, Electrical World
Class. Adv. Div., P.O. Box 12, N. Y. 36, N. Y.

ELEC. ENGINEER REA SYSTEM
IN CENTRAL ALASKA

Requires engr. with first rate utility and admin. experience. Should be versed on REA methods. Salary to $15,000.00 a year. Write to

MANAGER
GOLDEN VALLEY ELECTRIC
758 Illinois St. Fairbanks, Alaska

ADVERTISING MANAGER

Leading electrical equipment manufacturer seeks a qualified advertising manager. Should be electrical engineer with utility sales experience. Creative and administrative experience desirable.

Write Mr. L. Barre,
R T & E Corporation, Waukesha, Wisconsin.

RATE ENGINEER

We need another high-caliber Utility Rate Engineer for the consulting staff of our Rate Department. If you have the following qualifications and like challenging, interesting work we would like to hear from you:

1. B.S. degree in Engineering—preferably EE or ME.
2. Five years or more rate experience —with electric or gas utility, preferably both.
3. Ability to analyze, design and administer utility rate structures, and to analyze costs of service and competitive rate conditions.

If, in addition, you have had some experience in dealing with governmental regulatory agencies, it would be helpful. Ability to write effective reports is important, too. A limited amount of travel will be required.

Send confidential resume and salary requirements to:

COMMONWEALTH SERVICES INC.
300 Park Avenue, New York 22, N. Y.
Attn: Walter Bishop, Personnel Manager

TRANSFORMERS

1—6667 kva Westinghouse, 3/60/115,000Y/13750
1—6000 kva G.E. 3/66000/2400/4160Y
1—2000 kva Nia. Askrael, 3/13800/14160Y/2400
3—1000 kva Westinghouse, 1/22900/480
3—1000 kva Westinghouse, 1/13800/480
3—1000 kva Westinghouse, 1/13800/2400/4160Y
3—1000 kva Standard, 1/44000/6900
3—1000 kva Standard, 1/69000/4160Y/2400
3—1000 kva Standard, 1/34400/480
3— 833 kva Allis Chalmers 1/60/12,000—480
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3— 100 kva G.E., 2400/4160Y—120x240
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Atlantic
Electric Meter Corp.
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NEW • REBUILT
ELECTRIC EQUIPMENT CO.
WORLD'S LARGEST INVENTORY
CALL COLLECT GL 3-6781
P. O. BOX 51 • ROCHESTER 1, N. Y.

Pozzalanic paving, big heat pump are highlights at Brentwood center, which is . . .

A $3-Million Decentralization Step for LILCO

Rapid growth in Long Island Lighting Co's service area is reflected in a new $3-million operations center which opened this month. The decentralization move has shifted about 200 employees of customers' service, new business, commercial, and meter and test departments plus 500 operating employees to the Brentwood facility.

Nearly 100,000 sq ft of enclosed space is available at the headquarters, 65,000 sq ft of it in the office building (left foreground).

LILCO used some of its own fly ash to form a pozzalanic material for 18 acres of paving. This new use of an old Roman custom saved almost $62,000 over normal paving costs.

The office building has an electric heat pump of 3.95-million Btu/hr heating and 2.99-million cooling capacity. The device has two water-to-air pumps.

John J. Tuohy, LILCO president, said the project's functional design will keep maintenance costs at a minimum. "The buildings are constructed of lightweight concrete blocks, with brick veneer around a supporting structure of structural steel," he told visitors to the Dec. 14 opening.

Preliminary engineering and final design of yard facilities were handled by the company's engineering department. Field supervision and coordination of construction was provided by its construction department. Construction began in October, 1958.

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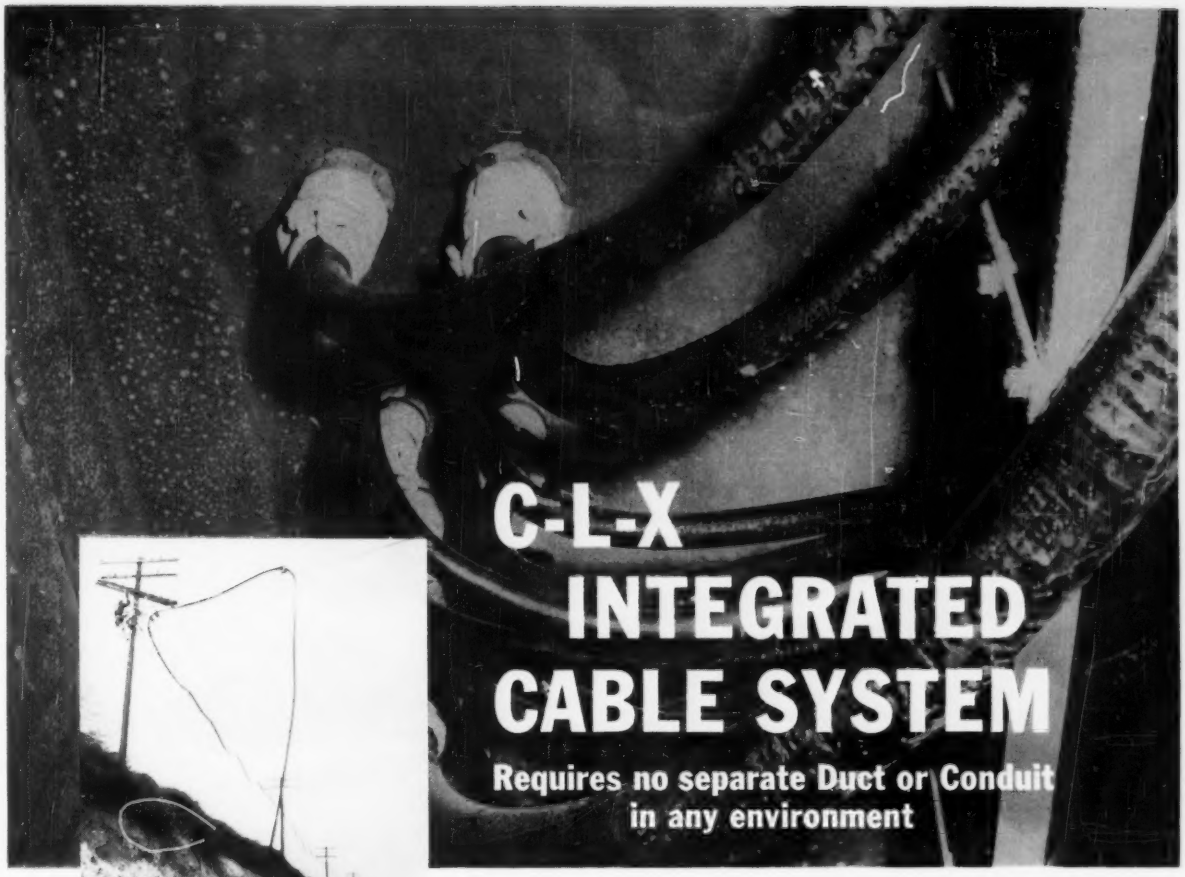
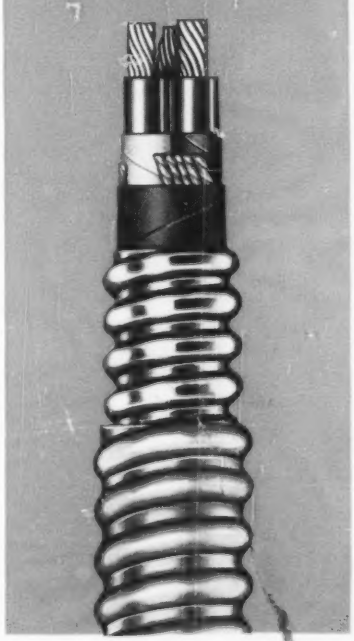


C-L-X INTEGRATED CABLE SYSTEM

Requires no separate Duct or Conduit in any environment

Unusual pliability of C-L-X Sheathed Cables is shown here as the cable is being installed.



The revolutionary C-L-X Continuous, Corrugated, Lightweight, metallic sheath, that Simplex introduced to this country two years ago, is now available in *Aluminum*, *Copper* or *Bronze* as well as the enormously successful *Steel*.

Simplex C-L-X pliable cable systems provide unexcelled ease of installation and mechanical protection.

The *corrugated* metal sheath combines pliability for ease of installation with very great strength and seals the cable against penetration by oil, chemicals and moisture.

Depending on the environmental conditions of the installation, these power, control and communication cable systems can be furnished with or without plastic jacketing.

Light, and pliable, C-L-X cables are easily installed, and require no special reels.

Now, with corrugated *Aluminum*, *Copper* or *Bronze* sheathed C-L-X cable systems, the low resistance of these metals permits designs where the sheath may be used as a neutral or ground. These metals also permit the use of single as well as multiconductor cable assemblies in a-c power systems.

For complete details on C-L-X sheathed cables, contact your Simplex Engineer, or write direct.

See C-L-X in Steel, Copper and Aluminum at the PLANT MAINTENANCE SHOW BOOTH NUMBER 212

Simplex

WIRE & CABLE COMPANY

79 Sidney Street, Cambridge, Massachusetts

INNOVATIONS IN FLUID HANDLING: #3 OF A SERIES

STEAM GENERATING GROUP | ELECTRIC GENERATING GROUP

As the manufacturer of all major components of the fluid handling group (pumps, condensers, deaerators, ejectors) Worthington has a reservoir of experience that can benefit you.

POTOMAC ELECTRIC POWER CO.
Dickerson Station, Units #1 & #2, 175 MW each

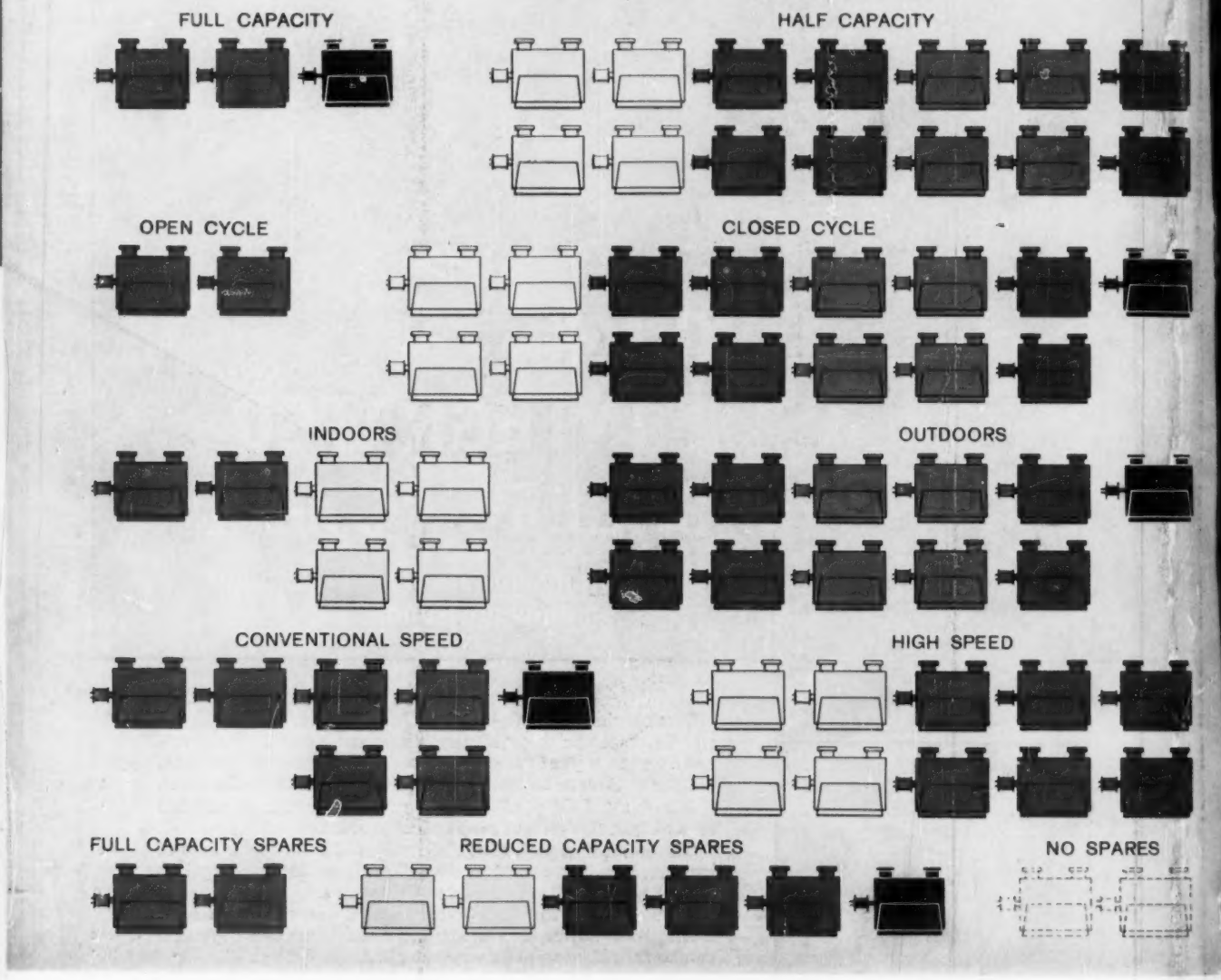
PUBLIC SERVICE ELECTRIC AND GAS CO. (N. J.)
Mercer Generating Station, Units #1 & #2, 320 MW each

LOUISIANA POWER & LIGHT CO.
Little Gypsy Station, Unit #1, 230 MW

PACIFIC GAS & ELECTRIC CO.
Pittsburg Station, Units #5 & #6, 325 MW each

PUBLIC SERVICE ELECTRIC AND GAS CO. (N. J.)
Bergen Generating Station, Units #1 & #2, 290 MW each

PUBLIC SERVICE ELECTRIC AND GAS CO. (N. J.)
Sewaren Generating Station, Unit #5, 342 MW



Worthington units are leading the trend to . . .

MAIN DRIVE FEED PUMPS

Driving boiler feed pumps from the main generator shaft is a promising way of cutting power station costs. And Worthington feed pumps are being used to prove out this new idea.

Seventeen Worthington boiler feed pumps, main generator driven, are installed or will soon be installed. These 17 pumps plus their 8 spares will help to generate a total of 2,792,000 kilowatts in 10 separate installations.

Some of the characteristics of each of these pumps are shown. As you can see, there is a wide variety of applications. Some are indoor, some outdoor. Some for open cycle, some for closed. Some operate at conventional speeds of 3500 rpm, some at higher speeds. Some are half capacity pumps, others are full capacity. Some operate with full capacity spares, some with reduced capacity spares, others with no spares.

There is a good reason why most main generator driven pumps bear the Worthington nameplate. Whenever progress must be made, whenever the electric utility industry must forge ahead, more and more companies call on Worthington first . . . for pumps, condensers, deaerators and ejectors. Why don't you do the same?

For a copy of "Economics of Main Turbine Drives," write to Worthington Corporation, Section 45-11, Harrison, New Jersey. Ask for RP-931.

WORTHINGTON